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Heat in Industry

PASSING a large generating station by train the other day we observed a sign on the water-softeners advocating the use of electricity for heat. Arriving at our destination in an industrial town we found a similar notice outside the showroom of the local undertaking. A few years ago such notices would have urged the merits of electricity for power, and, earlier still, for light.

These notices symbolise the trend of progress in our industry. The supremacy of electric light indoors is unchallenged nowadays; for power electricity has much leeway to make up to consolidate its position as rapidly as we all would wish; but it is to the conversion of electricity to heat that we must look for most of the big loads of the future. It is the application of heat to industrial processes that we have at present in mind.

Objections will come from those—and they are not all outside our own industry—who argue that as there are only 3,412 B.th.u. in a kWh, and as under the best conditions of production we cannot hope to use more than 25 per cent. of the heat units in the coal consumed, there can be little future for electricity as a heating medium. This may be correct arithmetic, but it is little else.

The same criticism might be applied, if in a smaller degree, to the use of electricity for many purposes for which it has demonstrated its superiority. It leaves out of account not only efficiency of utilisation, but also—what is the crux of the matter—the value of the improvement in the product that may be brought about, since electricity often provides not merely an alternative way of doing things, but a new tool for industry.

Manufacturing technique in Great Britain can provide, and has provided, apparatus that meets the requirements of most industrial heating processes. The most pressing need is that there shall be attached to the staff of each undertaking operating in an industrial area an engineer or engineers who are specialists in this class of work—men who have not only a general knowledge of electric furnaces but have studied the special problems relating to the area concerned. They must be able, as experts, to initiate schemes that will command the respect of the works owners, and be able to prove their contentions up to the hilt.

That there are such men engaged in electricity supply work is evident from the progress made in the areas of some undertakings, and from the articles contributed by them to these columns. But are young engineers being trained, or training themselves, in sufficient numbers to meet the future demands for industrial heating, or are they still concentrating their thoughts on the narrowing field of the power station?

Industrial heating problems, if properly tackled, call for a degree of technical knowledge quite as high as in any other branch of supply work, and also provide scope for abilities that can owe little to books. Here is a field well worth the attention of those seeking an outlet for their energies. And if the supply authorities employing them are wise it should be a not unprofitable field.

Enterprise in China

A YEAR ago the British Economic Mission to the Far East, of which Col. R. K. Morcom was a member, published its report upon the position of Great Britain in the external trade of China and Japan. The Mission, although not too optimistic regarding our chances in Japan, showed that the electrical awakening of China provided increasing opportunities for business. Two important recommendations were made: first, that the matter of long-term credits should be thoroughly gone into, and, secondly, that British manufacturers should form groups for export purposes. Joint representation in this market is no new thing, but the combination of a number of leading British engineering concerns reported in this issue appears to be an effort on a considerably larger scale than anything done so far. The plan is to draw up large schemes for presentation to the Chinese authorities; the group will assume complete responsibility for them, and thus secure the necessary financial support which would be lacking for plans prepared by contractors of less eminence in their field than the com-

panies concerned. Speaking at Callender's meeting on Tuesday last, Sir J. Fortescue Flannery said that it was hoped that the scheme would bring much-needed work to British factories, and we feel sure that the enterprise of these companies will not go unrewarded.

The I.E.E. Council

THE nominations to fill the vacancies on the I.E.E. Council which will occur on September 30th were published on Tuesday. The name of the president-elect, Professor E. W. Marchant, is associated in the minds of all with his educational work in Liverpool and also on I.E.E. committees. It would appear that the interests of the younger men in the profession are likely to receive due attention from two aspects, as the new vice-president, Mr. H. T. Young, who acted recently as liaison officer with the London Students' Section, has pronounced views on the desirability of the younger members considering careers as sales engineers. They will be reinforced by Professor Catterson-Smith, who may be regarded as filling the vacancy caused by the death of Professor Ernest Wilson. Two cable-makers drop out in Messrs. B. Welbourn and E. Leete, but Mr. P. Rosling, who succeeds the latter as hon. treasurer, has similar interests. Mr. H. W. H. Richards, as a railway electrical engineer, was most helpful to the last Weir Committee, and should prove an asset, but the Council is losing the service of Mr. A. R. Cooper, of the Underground Railways. Two instrument makers, Messrs. R. S. Whipple and E. E. Sharp, are retiring, but the heavy switchgear element will be strengthened by the return of Mr. T. Carter. Associate Members will be represented by Mr. W. S. Burge, an operation engineer with experience similar to that of a large proportion of the members in this group.

The I.E.E. Summer Meeting

THE arrangements for this year's summer meeting of the Institution of Electrical Engineers combine instruction, entertainment, and an opportunity to recuperate from the effects of the rather damp spring and the worries of the economic crisis. The choice of Harrogate as headquarters was excellent, and a full and varied programme has been arranged. Visits to a grid substation, one large company and two municipal power stations, a modern colliery, two engineering works, and a chocolate factory, interspersed with civic entertainment and delightful Yorkshire moorland excursions, will leave the visitors, some of whom will be recognised on the facing page, little time for anything more than the merest sampling of the "cure," which is distinguished by several features: the variety and quality of the medicinal springs, which are eighty-eight in number, all natural and constant in flow, have made the Royal Baths and Pump Room renowned the world over. More than one hundred different curative methods are practised; electro-medical treatment was introduced thirty-five years ago, and a recent discovery was the finding locally of radio-active mud—the "Fango" which is so much used on the Continent.

A Bitumen-Gas Explosion

IT is probably necessary to go back some twenty years, to the explosion of bituminous gas at Hebburn, to find a parallel to the recent case at Bootle, and the view expressed at the inquest by Mr. P. J. Robinson, the Liverpool borough electrical engineer, that there is no need for the inhabitants to live in fear of similar trouble, seems justified enough. The v.b. mains at Bootle were laid in bitumen in wood troughing in 1900, and the bitumen appears to have contained a higher proportion of volatile matter than usual. The v.b. solid system had a considerable vogue for small d.c. networks up to about 1909; it was cheap, and, although osmosis troubles made it unreliable, faults were easily located and a joint could be made in those days for about 15s., complete. Coal gas was not to blame in the Bootle case, but we have seen v.b. cable reduced to extreme sponginess through the proximity of leaky gas mains. Present-day loads, fortunately, are large enough to eliminate cheapness as the first consideration in designing distribution networks. Mr. Robinson is gradually relaying his Bootle legacy; in many areas excellent results in maintenance saving have followed a change to alternating current.

L.P. System Its Own Diagram

A MODERN e.h.p. or h.p. supply system is incomplete without a mimic diagram; indeed, with present-day large-scale and complicated lay-outs it is only possible for the control engineer to visualise what is happening on the system with the help of such a picture. Because of its greater ramifications the l.p. system diagram may be said to be even more necessary, and for the same reason it is usually impossible. Practice generally boils down to a drawing of each sub-station with connections near at hand. Drawings, however, are often not kept up to date, and there is a tendency "not to have time to consult them" in emergency. Why not make the l.p. bus-bar system, etc., its own diagram? Suitably placed, spaced and coloured, the bus bars, leads, connecting boxes, etc., can be built up into an easily readable diagram. We had proof of this recently when inspecting some sub-stations at Stoke-on-Trent.

Greater Efficiency, Less Consumption

WE believe there is one important aspect of the general movement among industrial consumers to bring their installations up to date which has been largely overlooked. Greater installation efficiency must mean lower consumption, and anything like a wide movement must leave its mark on the supply industry. There is a tendency for supply engineers not to consider this seriously; they apparently believe that the reduced consumption can be only about two or three per cent. But we learn of consumptions being reduced by half, and in one case the adoption of ball bearings for line shafting, etc., resulted in a consumption decrease to one-third for the same output. The movement is all to the good, and will all the more reflect credit on electrical driving—in the long run. It is essential, though, that the supply engineer should be wise as to what is happening.

Cleaner Business

FOR several years past one of the horrors of the housewife has been the itinerant vendor of suction cleaners, and she, like Dame Nature, has come to abhor a "vacuum." The nuisance has reached such a pitch that it has practically killed its object, and people are inclined either not to buy a cleaner at all or to obtain one with which they have not been pestered. The lesson has not been lost on some of the more enlightened manufacturers, and we observe welcome signs of a tendency to replace the high-pressure door-to-door salesman by proper co-operation with the retail trade—the only method of building up a stable business. It may be said that such a change will cause further unemployment, but we venture to think that only a small proportion of these canvassers earn a livelihood. Those who do will be far better employed in exercising their talents upon the retailers, and the vacuum cleaner industry will secure corresponding advantage.

Telephone Fear

A CORRESPONDENT of *The Times* suggests that the Post Office should collaborate with the educational authorities in teaching young people how to use the telephone. This would be a good move; it is on a par with the training of the electrical idea in other domestic uses that is advocated by the E.A.W. An indirect effect, but one of possibly equal importance, would be the removal of the fear of using the telephone, which is still quite prevalent and handicaps the spread of telephony.

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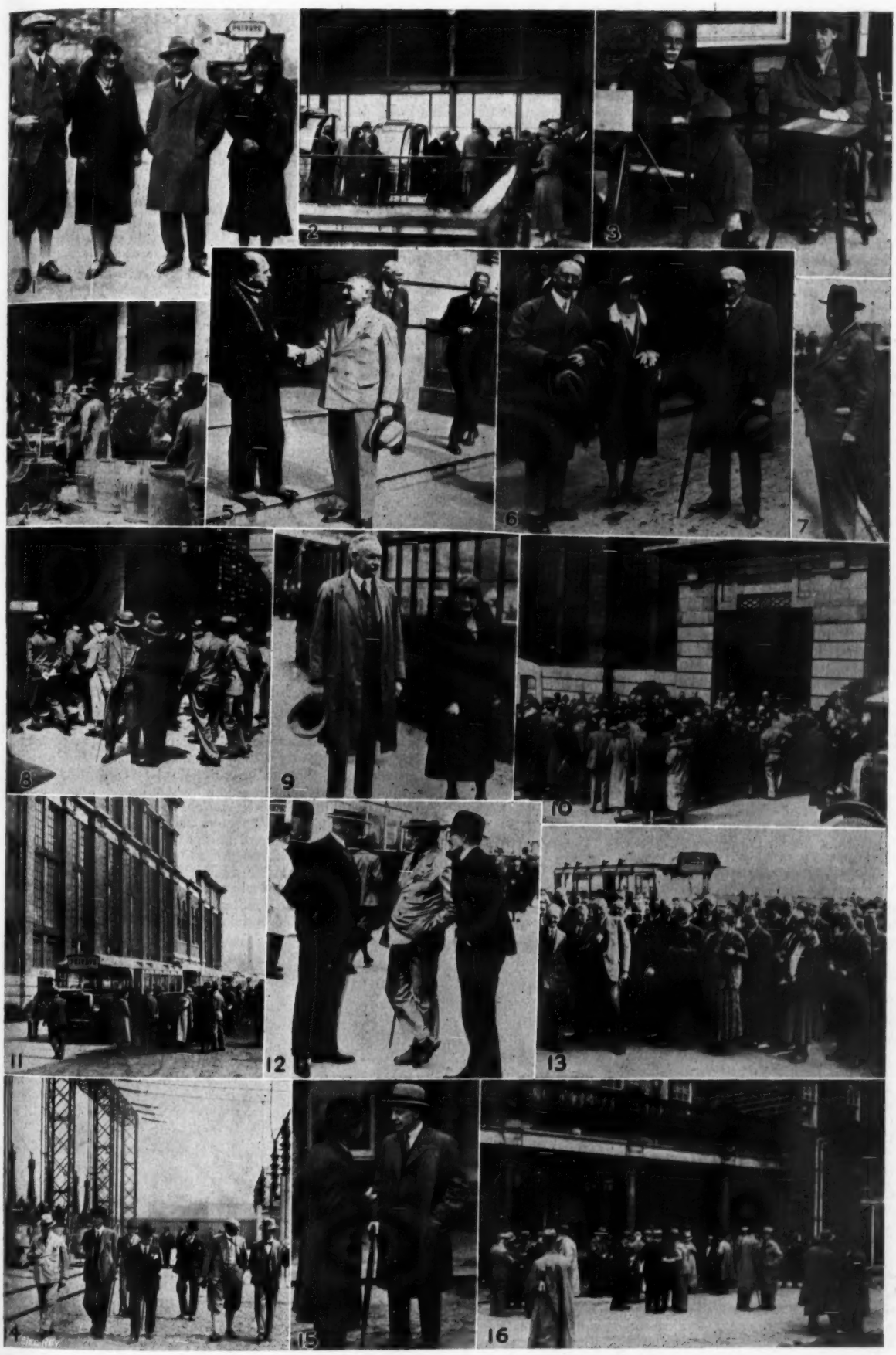


The Summer Meeting of the Institution of Electrical Engineers

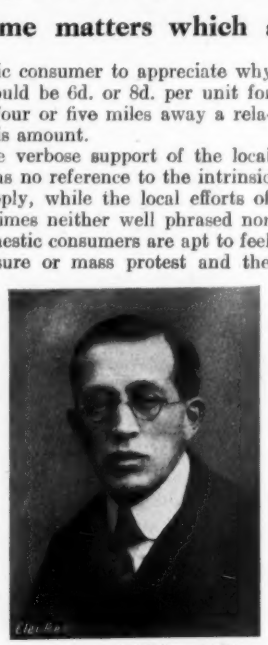
1. Mr. and Mrs. F. S. G. Hinings and Mr. and Mrs. V. Z. de Ferranti. 2. Delegates at Kirkstall. 3. Dr. E. H. Rayner and Mrs. Dunsheath. 4. In Hopkinson's foundry. 5. The Lord Mayor of Leeds greets the President; right) Mr. C. N. Hefford. 6. Mr. and Mrs. C. C. Paterson and Mr. F. W. Crawter. 7. Mr. W. B. Woodhouse. 8. Entering the Britannia Works. 9. Mr. and Mrs. P. F. Rowell. 10. The Lord Mayor welcoming delegates to Kirkstall. 11. Arriving at the power station. 12. Messrs. A. M. Siliar, J. M. Donaldson, and P. B. Silk. 13. Mr. R. A. Chattock and other delegates. 14. Inspecting the grid sub-station. 15. Mr. S. C. Hall and Sir Archibald Page. 16. At headquarters, Harrogate.

The Consumer's Point of View. By W. P. Digby, M.I.E.E.

Some matters which are not easily understood

IT is not easy for the domestic consumer to appreciate why in one district the price should be 6d. or 8d. per unit for domestic lighting, whereas four or five miles away a relative may be paying only half this amount.

Usually the consumer has the verbose support of the local Press, but such support often has no reference to the intrinsic facts governing the cost of supply, while the local efforts of ratepayers' associations are at times neither well phrased nor convincing. In some areas, domestic consumers are apt to feel that except for the mass pressure or mass protest and the assistance that the Press will give, they are very much at a disadvantage when pressing for a reduction of flat-rate charges.



[*Wykeham Studios.*

Mr. W. P. Digby is a consultant with many years of varied engineering experience. He has frequently contributed to our columns, and acted as our special correspondent at the Turin International Electrical Conference of 1911

Very few domestic consumers keep records from quarter to quarter of the price they are paying per unit on a two-part tariff, and this leads to dissatisfaction at the high charges per unit in summer. Thus, consumer "M" living in a suburb of an industrial city, "N," consumes per annum 7,000 kWh, 700 in lighting, 6,300 in living-room fires, no current being used for cooking, hot plates, or electric irons. His fixed charge based on the assessment of his house is £22 per annum; the unit rate is ¾d. His annual average cost per kWh consumed is 1.50d. His lighting load varies from 3.4 kWh per day in December to 0.68 kWh between June and September. In December his heating load is about 30 kWh per day—from June to September heating only took 9 kWh. His seventy-two summer kWh therefore apparently cost him £5 14s. 6d., or slightly over 19d. each. His 1,035 December kWh at 0.75d. plus one-twelfth of the fixed charge would cost £5 1s. 7d. or 1.178d. each.

The Alternative Flat Rates

It is best in all discussions to emphasise the annual average cost or to contrast the effect on his bills if he had chosen the flat rates of the N. Corporation Electricity Department of 8d. per kWh for lighting and 1d. per kWh for power.

Let us assume that "M" moves to a suburban district "X" about ten miles outside the London County Council area and within seven miles of the town hall of a borough with nearly a quarter of a million inhabitants. If he takes with him his electric radiators and his consumption is identical, his annual bill will be: 700 lighting kWh at 8d., £23 6s. 8d.; 6,300 heating kWh at 4d., £105.

It is bad tactics to solicit the householder who has a small lighting load only to accept a two-part tariff. The comparative costs in one such case that was brought to my notice were as follows:—

Two-part tariff: Fixed charge at 15s. per quarter, £3; unit charge, 96 kWh at ¾d., 6s.; total £3 6s.

Flat-rate tariff: Unit charge, 96 kWh at 6d., £2 8s.; meter rent, 2s. 6d. per quarter, 10s.; total £2 18s.

Loss by adopting two-part tariff, 8s. per annum or ¼d. per kWh.

Power Consumers

When we come to power consumers taking from 100,000 to 400,000 kWh per annum, the choice of the alternatives of a graded flat-rate tariff or of a two-rate tariff is very frequently in favour of the former. Many power consumers view their maximum demand meters with suspicion that is understandable when the demand indicator is of the ampere-hour rotating-disc type, not compensated for pressure variations, and the maximum demand is calculated on a kVA basis reckoned as the product of the current and the declared pressure, subject to a variation of 4 per cent. The consumer will appreciate that his heaviest loads may synchronise with the minimum voltage.

The consumer may also feel that the maximum demand charge is unduly severe if the accounting period is a yearly one. The variation in different districts in the ratio between the maximum demand and the unit charges is also perplexing.

It would be helpful if there was a simple standardised basis of determining the amount to be charged per kVA or kW of maximum demand, and the ratio which the rate to be charged should bear to the cost per kWh generated.

The commercial directors of a manufacturing company do not easily comprehend that expenditure on static condensers or synchronous motors to correct the power factor, involving them in fresh capital outlay, may yield a very good return. One such said to me: "You tell me that if I put in static condensers, they themselves take electrical energy to operate them; you then say that the result of putting in plant to take more current means that my charges will be less."

Another difficulty is of explaining how it may be possible by spacing factory operations to give the best possible load factor to keep power costs down to a minimum.

Some authorities deprecate strongly crediting any type of supply with advantages of a temporary nature, such as a smaller proportion than its permanent share of the capital costs, or such considerations as the precise hour of peak load. They urge that considerations of this nature involve difficulties of adjustment to a correct figure when the users' conditions have ceased to be temporary. The other school urges that the development of high load-factor business even at prices below the unit rate paid for the time being may be justified. Equity would be reached if a common agreement could be found prescribing a system of sliding scale rebates on the unit charge, varying with the ratio between the power-station load factor and the consumer's load factor so that as the former increased the temporary rebate would tend to be less.

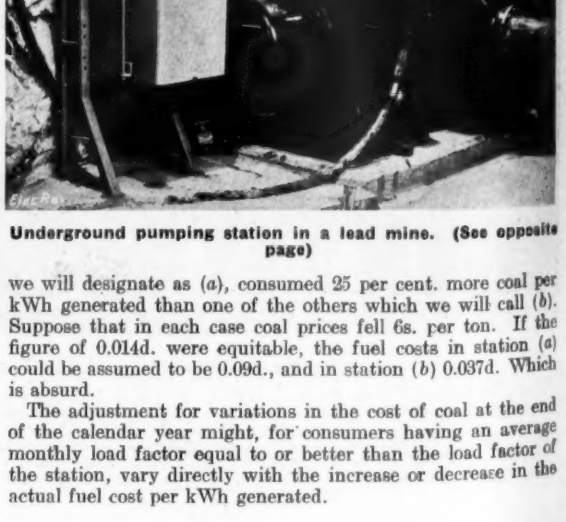
Coal Price Adjustment Clauses

Fuel which accounts in some undertakings for 30 to 40 per cent. of the running cost is unstable in price; it is only equitable that those purchasing larger quantities of energy at close prices should in times of common stress bear their share of any increase. One form of coal clause reads as follows:—

"To the unit charge there shall be added or deducted the sum of ..... pence per Board of Trade unit supplied for each one shilling (and pro rata for smaller rates than one shilling) by which the cost of the coal delivered into the bunkers is above or below ..... shillings per ton."

The clause quoted bears no relation to the thermal value of the coal, even where its price is adjusted for fluctuations in such value. Of still greater consequence is the fact that with a rate of adjustment fixed for a term of years, the consumer reaps no advantage from the general reduction in fuel cost per kWh generated through improved load factor, or by the installation of more efficient prime movers.

The interlinking of power stations complicates the question still further. Station load factors vary—so does their thermal efficiency. The cost of coal at the different stations is not a constant figure; sometimes the adjustment rate is excessive. In one case coming under my notice the datum cost of coal was taken at 15s. and the plus and minus variation was 0.014d. per kWh for each one shilling variation in the price per ton. Three large interlinked stations supplied the area—one, which



Underground pumping station in a lead mine. (See opposite page)

we will designate as (*a*), consumed 25 per cent. more coal per kWh generated than one of the others which we will call (*b*). Suppose that in each case coal prices fell 6s. per ton. If the figure of 0.014d. were equitable, the fuel costs in station (*a*) could be assumed to be 0.09d., and in station (*b*) 0.037d. Which is absurd.

The adjustment for variations in the cost of coal at the end of the calendar year might, for consumers having an average monthly load factor equal to or better than the load factor of the station, vary directly with the increase or decrease in the actual fuel cost per kWh generated.

Electricity in Lead Mining

A recently converted installation

A LOAD factor of 93.8 per cent. (March); power factors of 84 and 89 per cent. for the 440- and 3,300-V systems, respectively, secured solely by excellent loading, with no synchronous motors, condensers, or special p.f. correction apparatus of any kind; and high-voltage transmission and transformation below ground are some of the features of particular interest pertaining to the electrical scheme at the lead mine and workings of the Mill Close Mines, Ltd., at Darley Dale, Matlock, Derbyshire, which were recently converted from steam driving.

The mine is believed to be the largest and the oldest of its kind in this country, and the consumption of over 550,000 kWh per month is, perhaps, an indication of its size—certainly, coupled with the opening figures, of its value as a consumer.

General view of the above-ground workings

Conversion to electric driving is one indication of the progressive policy of the company, and of Mr. L. B. Williams, the general manager, who controls the whole workings. Credit should also be given to Mr. G. T. Spencer, chief electrician, who, in collaboration with Mr. W. R. Degenhardt, consulting engineer to the company, has been responsible for the design and erection of the installation.

Handling the Ore

Lead ore is found in the limestone strata and mixed with calcite (spar) in the caverns and rocks below ground at a depth of from 240 to over 600 ft. At present the mine is working only at the 558-ft. level, but the company is exploring for ore at a much greater depth. Drilling and blasting release the rock at the working faces, and compressed-air hammer drills are supplied at 80 lb./sq. in. from the surface. The compressor has a capacity of 900 cu. ft. per min., and is driven by a 158-h.p. Lancashire s.r. motor, controlled by an Ellison oil-immersed drum-type starter.

The ore is hand pushed to an internal vertical shaft in trucks on a light railway, and is hauled up the shaft from the 558-ft. level to the 420-ft. level by double-drum winding gear driven by a 35-h.p., E.C.C. s.r. 440-V motor, controlled by an Allen West drum-type starter. This equipment will lift 26 cwt. at 400 ft. per min. Electric locomotives convey the material along the 420-ft. level a distance of threequarters of a mile. These B.E.V. tractors are each equipped with a 50-V D.P. battery and a 3½-h.p. motor. The batteries have a capacity of 225 Ah, and are of the "KA 15" traction type, made up into four trays for convenience of handling. Each locomotive will haul 200 trucks per eight-hour shift, and twelve trucks, each containing 12 cwt. of rock, at a time.

At the 420-ft. level there is a battery-charging station, supplied from a 110-V (d.c.) motor-generator at the surface. It is a simple resistance board, and will charge two batteries at a time in thirty-five minutes. At the end of the threequarter mile tunnel the ore is elevated up the main winding shaft to the surface by steam haulage equipment.

The major part of the electrical work is water pumping from the mine, a total of 1,345 h.p. of motors being installed for this purpose. The total h.p. installed is 1,660, and the difference is wholly utilised above ground. Prior to the conversion all the pumping was effected from the surface by Cornish beam pumps. Actually in use at present for pumping there is 715 h.p., the remaining 630 h.p. serving as standby plant and for future development.

As usual in lead mining (we were informed) artesian water dominates all operations. The water is clear and cold, and the quantity does not vary. Some 2,850 gallons are pumped to the surface continuously per minute. Two Mather and Platt pumps at the 618-ft. level (now being developed) are not yet in use. They will deal jointly with 2,250 gallons per minute, against a 215-ft. head. The motors are of 150 and 75 h.p., respectively, s.r. 3,300 V, and are served by Allen West oil-immersed face-plate starting gear. The scheme is for these equipments to pump the water to the 420-ft. level.

The Pumping Stations

At the 558-ft. level there are two pumping stations. One is equipped with a Mather & Platt pump driven by a 160-h.p., 440-V motor, which is capable of lifting 2,250 gallons of water against a 160-ft. head. The other station has two Worthington Simpson pumps working in series, each driven by a 90-h.p. 440-V motor. This group handles 2,500 gallons under a 70-ft. head.

Winding gear for internal shaft at the 420-ft. level

Underground battery-charging station

This water is then dealt with by a Rees Roturbo pump served by a 100-h.p. motor, and delivered a further 115 ft. vertically to the 420-ft. level, where it gravitates along the main haulage way to the bottom of Warren Carr pump shaft from which it is lifted to the surface by a 440-h.p., 3,300-V M. & P. s.r. motor pump at the rate of 2,500 gallons per min. under a 410-ft. head. This motor is controlled by a G.E.C.

liquid starter and oil circuit breaker. The water at the surface is delivered to the adit, a man-made waterway now regarded as a natural stream which flows into the River Derwent. At the 300-ft. level there is a 100-h.p. M. & P. pump which delivers 650 gallons of water per minute to the crushing plant, to be referred to later, against a head of 400 ft. The motor is served by an Allen West face-plate starter.

Deep Underground Sub-station

To reduce cabling down the shaft as much as possible transformation is effected below ground at the 420-ft. level, where there is a transforming and distribution station equipped with one 150-kVA and one 75-kVA transformers in parallel, stepping down to 440 V for power, and a small 440/100-V transformer for lighting. The lighting voltage is between phases, and the neutral is not used, because it is easier to deal with a case of shock without it. The transformers are of the J. and P. oil-cooled mining type. The distribution switchgear in this underground station is of J. and P. (h.p.) and Ellison (l.p.) makes.

Down the shafts the cables, p.i. l.c., double w.a., are hung

Transformer and distribution station at 420-ft. level

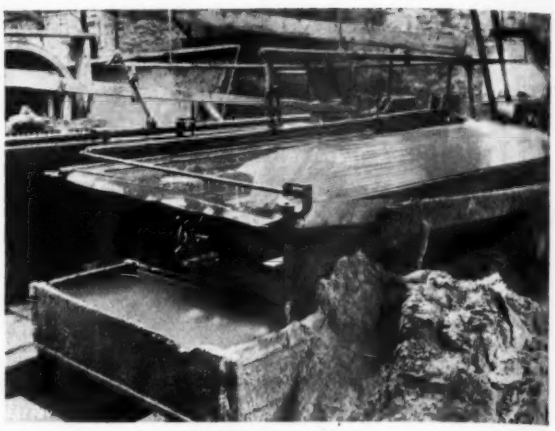
in wood cleats, clamped together with eight ¾-in. bolts, secured to the shaft wall by large eye bolts. Along the levels the cables are hung about 4 ft. high by webbing-type suspenders attached to hooks let into the walls. All the pump chambers, &c., below ground have had to be blasted out of the solid rock.

On receipt of the material at the pit-head it is conveyed to the mill by a double-drum incline haulage up a 1 in 3 gradient. This is driven by a 12-h.p., 440-V, E.C.C. s.r. motor, and it will haul two trucks at 450 ft. per min. The motor is controlled by an Allen West tramway-type starter.

Crushing and Screening

At the mill the ore is delivered into a storage bin from which it is passed through a jaw-type crusher, with a consequent reduction in size to about 1½ in. It is then passed along the sorting table to rolls which further reduce it to ¾ in. From the rolls it is conveyed and elevated to classifying trommels, similar to revolving-drum screens, and then to separating jig equipments.

Each of these equipments is a wood trough structure with two compartments lengthwise. In one compartment flows the crushed ore mixture and water, and on the other side are the cam-operated jigs which, in their pump-like action, give



A Wilfley table

a pulsating motion to the mixture, with the result that the heavy portions (lead ore proper) fall to the bottom of the trough and through a screen. The limestone and spar at the top of the trough are kept moving by the flowing water and removed at the end of the trough by chutes and conveyed to the dump.

Between 500 and 600 gallons of water per minute are used for washing the ore alone. The fine solids with this water are passed over Wilfley tables. The table is oscillated in a horizontal plane at 260 strokes per min., with the result that the lead is separated from the fine sand and leaves the table at one end, the water washing the sand off the table at the side. The larger pieces of ore from the jigs, and the finer material from the tables are removed to a common dump for conveyance to smelting furnaces where the finished article, pig lead, is produced.

Mill Driving Equipment

For driving purposes the complete mill may be considered as two units. The crushing and milling plant is driven by a 35-h.p., 440-V, s.r. E.C.C. motor, controlled by an Allen West oil-immersed face-plate starter, with contactor gear, and the jigging equipments and elevators are driven by a 70-h.p. Crompton Parkinson motor with an Allen West rotor starter. The whole of the mill plant is designed to deal with 200 tons of ore for milling and dressing per day.

Electricity is received from the Derbyshire and Nottinghamshire Electric Power Co. at 11,000 V by duplicate feeders, and is transformed down to 3,300 V and 440 V for distribution. All that at 3,300 V is used below ground. From the sub-station to the shaft a 3.3-kV cable (3-core, 0.06 sq. in., p.i. l.c., d.w.a.) is suspended from a catenary wire by cable "swings" at 3-ft. centres. The span is about 150 ft. A small motor-generator above ground serves for the mill and surface lighting. D.c. is preferred for this purpose because of protection difficulties—everything is very wet. Pumping and air compression are continuous operations.

The illustration of the above-ground workings on the preceding page shows, left to right: The Cornish beam-pump house; pit-head lifting equipment; shed housing the incline winder; section of the incline; gravel elevators; and a tramway to the gravel dump. Beyond the shed and elevator are the crushing rolls.

Jigging equipments for separating stone from the ore

Electrolytic Gold Refining

THE recent "gold rush" gave refiners of precious metals more than the usual amount of work to do in this somewhat limited section of their practice.

Gold refining is nowadays largely conducted by electrolysis, although some of the older fashioned refiners still adhere to the more protracted system of wet chemical separation.

The original process consisted of electrolysing rich anodes, containing over 90 per cent. of gold, whereby effective separation was made. In a hydrochloric acid electrolyte gold, platinum, palladium, copper, and lead dissolve anodically. Silver and the more precious of the platinum metals (iridium, rhodium, and ruthenium), remain chiefly in the slimes.

The large amount of slimes which formed made a high current density well-nigh impossible, even though the anodes were scraped every hour to remove the layer of silver chloride, &c., which is formed.

Since working at a low current density meant slow consumption of the anode, means had to be introduced to improve on this, and this was most effectively accomplished by employing alternating current.

Advantages of Superposed A.C.

The modern system consists of using a direct current, on which is superposed an alternating current of rather greater r.m.s. value. The addition of the a.c. does not add to the amounts of gold dissolved from the anode or deposited, which really only corresponds to those obtainable by d.c. alone. But the feature is that much higher current densities can be employed, overvoltage is almost eliminated, scarcely a trace of chlorine being evolved, whilst the gold dissolves quite smoothly.

For example, anodes made up of melted down sovereigns and other gold coins can be refined at a current density of 116 A per sq. ft., whereas in the absence of a.c. the maximum density permissible is only 70 A per sq. ft.

Apart from this, scraping is unnecessary in the modern process, but necessary in the latter. The a.c. is 1.1 times as great as the d.c. flowing, but this ratio may be considerably increased and is varied according to a pre-arranged scale.

Bullion containing upwards of 20 per cent. of silver may be refined at a current density of 112 A per sq. ft., whilst the ratio of a.c. is raised to 1.7.

Where comparatively pure bullion has to be refined much higher densities can be successfully used. The amount of gold which enters the anode slimes, and thereby requires further treatment, scarcely amounts to 1 per cent., proving that the a.c. exerts no detrimental influence, such as loosening the cathodic deposit.

Sovereigns

When the anodes are composed of sovereigns and similar gold coins, the slimes consist practically of silver chloride only. This forms a layer over the gold anode and lessens its active area, thus increasing the effective current density. When the latter exceeds a certain value (depending on the conditions) the anode becomes passive; the superposed current eliminates this.

Various theories have been offered to account for this action. It is suggested that the a.c. prevents the accumulation of oxygen or dissolved oxide on the surface of the metal. Since its cathodic period is somewhat short, the oxygen has time to diffuse away. Another hypothesis is that the layer of silver chloride itself is made less adherent and flakes off comparatively easily.

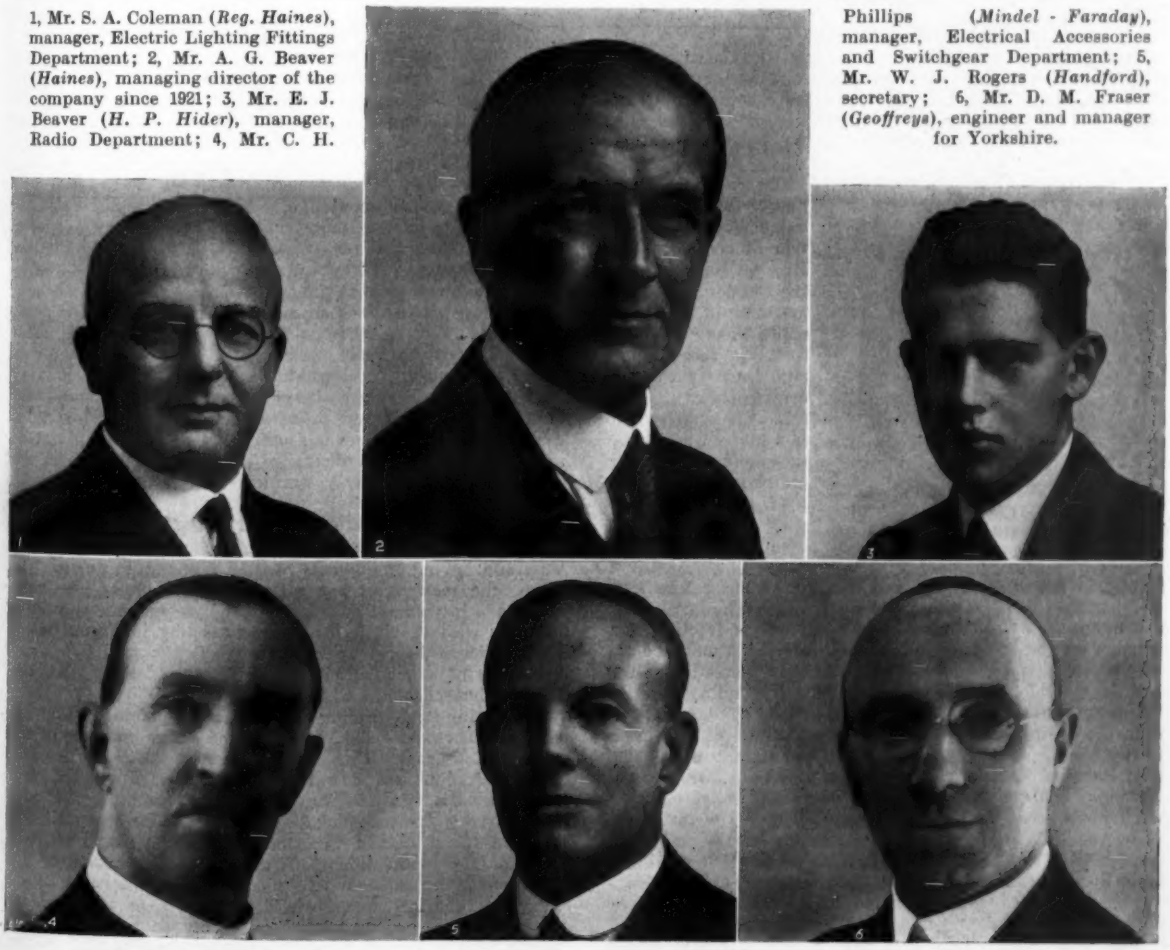
Opposition to this passivity is most effective when a.c. of low frequency is used. This lowering of the frequency has to be done in conjunction with the ratio of alternating to direct current, and is the most certain means of attacking passive layers yet known. As a general rule the passivity never gets a chance to commence its insidious action, and the surfaces of the metal remain more or less bright throughout the operation.

Prior to its introduction, it was customary to heat the electrolytes externally, not only in the above, but also in many other electrolytic systems, with a view primarily to eliminating overvoltage from whatever cause. The employment of superposed a.c. has made this heating unnecessary.

The refining of sovereigns is a comparatively simple matter owing to the consistent composition of the metal, and they are directly cast into anode moulds.

Allowing for 1 cm. clearance at the sides, the gold anode plates should not be over 48 cm. in width across the tank, and should not be more than 8 cm. above the bottom of the tank to allow space for the slimes to accumulate below. The immersed depth of the plates is therefore 40 cm. with a superficial area of 960 sq. cm. per side. Ignoring the edges of the plates, the working surface per tank is $960\times2\times5=9{,}600$ sq. cm., and the current is $9{,}600\div10{,}000\times1{,}000=960$ amperes. Given the width of the working spaces as 3.94 cm., the voltage to overcome ohmic resistance is $5\times3.94\times1{,}000/10{,}000=1.97$ V. A considerable addition has to be made for loss at contacts, which is best found by practice.—C. C. D.

1, Mr. S. A. Coleman (*Reg. Haines*), manager, Electric Lighting Fittings Department; 2, Mr. A. G. Beaver (*Haines*), managing director of the company since 1921; 3, Mr. E. J. Beaver (*H. P. Hider*), manager, Radio Department; 4, Mr. C. H. Phillips (*Mindel - Faraday*), manager, Electrical Accessories and Switchgear Department; 5, Mr. W. J. Rogers (*Handford*), secretary; 6, Mr. D. M. Fraser (*Geoffreys*), engineer and manager for Yorkshire.



Some Driving Forces in the Industry: The Sun Electrical Co., Ltd.

Insulation and Leakage. By J. O. Knowles, M.A.

Difficulties in obtaining reliable tests

THE period between routine tests of circuit insulation varies in practice very widely. Some working conditions are so bad that a motor may break down every six months; in other cases the insulation of a switchboard need be tested only once a year. This touches on a difficulty of insulation testing; a lamp on a main board may show a leakage on the system, causing a rise in voltage to the neutral, but, before any excessive leakage can be traced, it may be necessary to open a large number of sub-circuits to find the faulty one, unless the fault is sufficiently serious to clear itself by blowing a fuse or opening a circuit breaker.

It is possible that in the future a greater use will be made of leakage trips in conjunction with artificial earthing as developed (initially for rural areas) on the Continent. In this system the earth connection is broken and a sensitive relay coil introduced, which will operate and open the main circuit on leakage current of 20 to 25 milliamps. The opening of the circuit on such a low current (and in about 1½ cycles) may prevent a costly burn-out.

It is not always a final solution to disconnect the supply on the occurrence of small leakage currents of 20/25 milliamps. There are many power applications where the main cost of a stoppage is not that due to damage to the motor or wiring, but of an interruption in a process or sequence of processes. The manufacturer, who has to pledge his reputation on the safety of his insulation for months ahead, makes his insulation test standard 1, 2 or 10 megohms. On 200-V circuits these figures correspond to leakage currents not of 20/25 milliamps. but of 0.2, 0.1 and 0.02 milliamps. respectively. It is extremely difficult to determine the length of time that will elapse before a small leakage on a sub-circuit turns into a short circuit. Surface leakages may disappear on mica insulation which would remain on " Bakelite " or other insulations which carbonise on flashover. Surface moisture may evaporate before any damage is done. A momentary surge in voltage may break down an insulation which would withstand the normal voltage for a considerable time. The conductors in a motor winding may move slightly by expansion or electrical stress.

Effect of Temperature

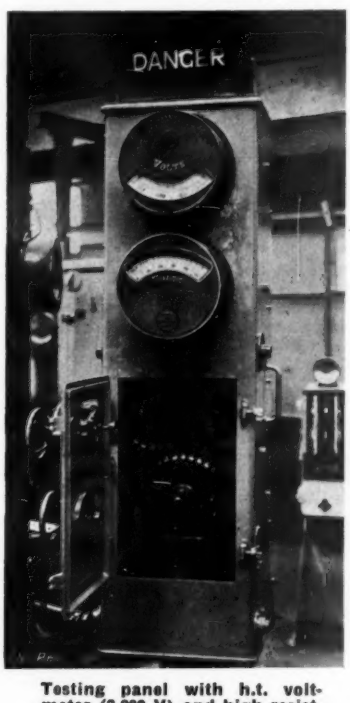
Certain forms of synthetic insulation have the characteristics of presenting a higher value of insulation when cold than when hot, and slight errors in temperature control in their preparation may magnify this characteristic and turn an insulation value of 50 megohms when cold into one of ¼ megohm or less when hot. " Cold " insulation tests may be misleading.

Insulation indicator (Bullen patent)

Experience shows that the " safe " value of the insulation of common sub-circuits must be of the order of one megohm in the tests made before installation. The actual value will vary with the complexity of the circuit. A simple switch may show 50 megohms but other more intricate plant may not show more than one or two megohms (unless specially guarded and dried out before testing). The brush gear of a motor in a bad situation may show only a fraction of a megohm on the routine test. At any rate, tests made before installation or at routine intervals must show insulation values corresponding to leakage currents under one milliampere.

A margin must also be given, in estimating a " safe " value of insulation resistance, because of the length of time that must elapse before another test of the insulation can be made. Most leakages come on slowly but are unnoticed owing to the absence of continuous indication of very *small* leakages. Most breakdowns occur through the premature ageing of insulation by overheating, or by a weak spot in the insulation failing eventually in spite of the manufacturer's test. These failures begin by a slow decrease in insulation resistance with a downward curve which does not begin to take on its final steep slope until the insulation is nearing its point of breakdown.

Now the " safe " limit for, say, a 50-h.p. motor circuit (with cable between starter and motor) is necessarily a higher insulation value than that of a whole factory or network. Suppose that the leakage current to earth on the whole insulated network is 25 milliamps. If the insulation resistance to earth on the 50-h.p. motor circuit drops from 1 megohm to ¼ megohm, the increase in leakage current will only be (at 250 V from live parts to earth) 0.33 milliamps. If, therefore, a milliameter is used as an earth leakage indicator on the main board, the only response to a serious drop in insulation resistance on an important motor circuit would be the moving of the pointer of a milliammeter from 25 to 25.33 (and a milliammeter with 50 m.a. scale would hardly show such a difference).



Testing panel with h.t. voltmeter (2,000 V) and high resistance (megohm) voltmeter

Capacity Currents

An additional difficulty in leakage testing with a.c. systems is capacity. If the network is connected to one phase of the supply only, so that except for leakage currents to earth (and back *via* earthed neutral) there can be no circuit, there will, in spite of excellent insulation to earth, still be found a capacity current which in even a small network may swamp the leakage current of the whole. The capacity of the network may be reasonably constant, and the leakage may be variable, but the constant factor may be too high to show the small variations unless the test is made in a small portion of the total circuit so that the capacity becomes very small and the possible variation in insulation resistance relatively high.

Indication of insulation safety would be a safeguard against breakdown. A reliable indicator should show differences which are still " safe " and not merely when insulation is so low that, if the leakage is localised at one (unknown) point, breakdown is imminent. Such indication must be applicable to sub-circuits and not confined to main switchboards.

Progress might be made on the lines of indicating the insulation value continuously (as an ammeter shows the load current continuously) or, alternatively, to design a trip or relay to operate on leakage currents of a fraction of a milliamp., and thus give warning of low insulation values, and not merely of " leakages " (as the term is usually applied). It would not be necessary for such an indicator of insulation to shut down the section or motor if timely warning were given.

A " Dual-scale " Instrument

An indicator of meter form can be obtained calibrated in volts and having an internal resistance of one megohm. In effect, the instrument has a double scale, giving the volts across the instrument and the value of the external resistance in series with it. It forms a direct reading insulation tester suitable for test-room work when supplied from a 500-V d.c. generator of small capacity, and placed in series with the circuit whose insulation is to be tested.

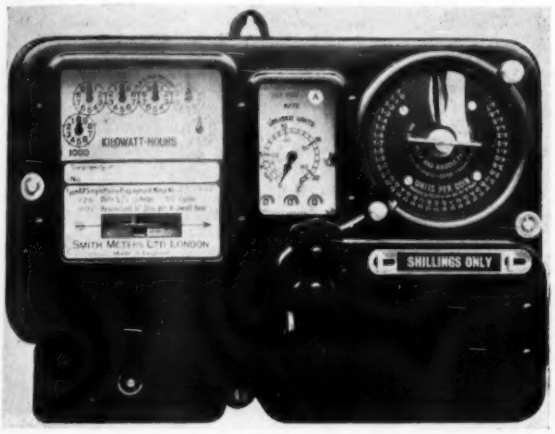
For testing large machines on d.c. supply before starting up, such an instrument could be connected across one pole of the main switch or circuit breaker (*i.e.*, connected to the live and the dead terminals of the switch on one pole). A potential from this pole would then be impressed on the armature field and switchgear of the machine, before the machine was switched on, and the insulation value of the machine would be read directly on the instrument. If the resistance to earth of the machine windings were 0.25 megohm, or 1 megohm or 10 megohms, the instrument would indicate these values on its megohm scale. (The latter would only be accurate if the supply voltage were at constant potential above earth.) When the main switch was closed the instrument would show no reading, but would not be in any way harmed. Similarly, if

A Hotel-fire Meter

WHAT appealed to us most during a recent visit to the Streatham Vale (London) Works of Smith Meters, Ltd., was the enthusiasm of Mr. H. E. Angold, electrical designer, over the possibilities of considerable business in connection with electric fires, with prepayment meters for exclusive charging, in visitors' rooms in hotels, &c.

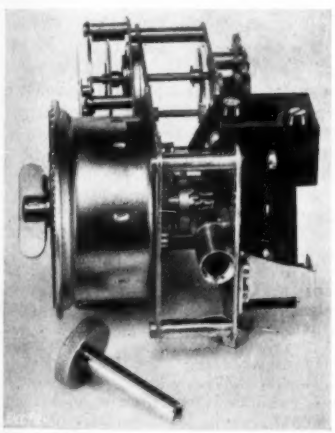
We agree that the electrical industry has only touched the fringe of this development, and that the company's new meter is a vital contribution towards getting the business. Incidentally, it is curious that the hotel-fire business has not been more sought after by the contractor. Is the necessary introduction of an integrating meter too strong a suggestion in favour of the supply undertaking? It certainly ought to be realised that the development represents not only a new source of revenue for the supply undertaking, but new work for the contractor.

But what is a suitable prepayment meter for the purpose



Smith variable-tariff meter

in question? No doubt Smith Meters would say: electrical characteristics apart, one that permits easy adjustment over a very wide range of tariffs without having to change wheels or parts of any description, and in which the hotel proprietor can readily reset the prepayment apparatus to zero in the event of a departing visitor leaving some "unused units," for these are the outstanding features of the latest production of the company.

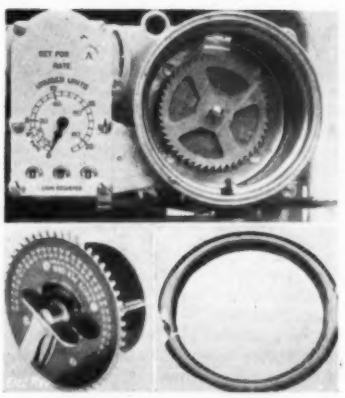


Side view of variable-tariff unit, showing resetting equipment

The Method of Operation

The working of the prepayment mechanism is perhaps nearer the watchmaker's than the average electrical engineer's heart, and it will be helpful, therefore, to outline the principle. Insertion of the coin, with the consequent locking of the winding gear and the subsequent "turn," results in a drive on the prepayment train gear in one direction, closing the switch and gearing this train on that of the meter proper. The prepayment train is driven "backwards" by the main train, with consequent switching off when the trip is again reached. All that remains to be done then when a visitor leaves "unused units" is to complete the backward drive, and this is effected by an intermediate bevel gearing on the main driving spindle, operated from the side of the case by a special one-way handle.

The essential principle governing the variable-tariff mechanism (it is claimed to be the only one which does not involve change of wheels, etc., for *in situ* adjustment) is varying the amount of electricity allowed per coin. This amount is dependent on the duration of the drive on the prepayment train, which, in turn, depends on the point of engagement between the coin "locking" mechanism and the train itself.

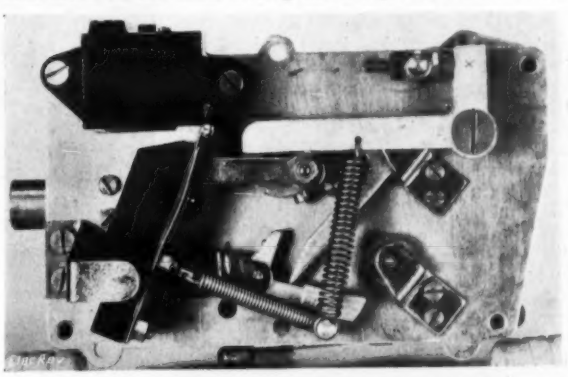


Variable-tariff mechanism; driving wheel at well base, coin gear displaced

The main driving wheel at the end of the well housing the coin mechanism has 50 teeth, engagement with most of which by the coin mechanism can be effected by varying the position in which the coin gear is inserted. The unit is withdrawn for resetting, according to the numbers on the front plate.

Provision for Varying Charges

Adding considerably to the flexibility of the whole arrangement, there is an auxiliary train in the rate dial for varying the ratio of the prepayment train drive from four to one, or *vice versa*, with the result that, according to the scale adopted, each tooth on the main driving wheel represents a 0.1 or 0.4



Contactor switch and operating mechanism at back of v.t. unit

kWh drive above or below its neighbour, and as shillings or sixpences can be provided for, there are four different groups of possible settings of 38 each, representing 152 different rates per kWh from 1s. to 0.319d.

Of course, the variable-tariff feature is not confined to the service of the hotel proprietor. It is available in the company's ordinary prepayment meter.

Recalling troubles years ago with the switches of prepayment meters, we were impressed by one particular feature of the switch in this meter. The switch is of the contactor type and is held in contact under a high pressure which constitutes the main energy for opening the switch. The result is that quite big contacts are used without any retarding effect.

The design of the switch mechanism, operating through an inverted cam, is such that no pressure or strain can be put on the train gear. A good strong spring is therefore permitted to govern the switch operation.

The meter is available in standard sizes of 2½, 5, 10, 20 and 25 A for the usual supply voltages.

Insulation and Leakage *(continued from the opposite page)*

the instrument were left across the open main switch, its high resistance would prevent damage, even if the conductors of the machine became earthed.

Neon-lamp Indication

A different method of securing insulation testing in simple form has been developed in the "Bullen" insulation indicator illustrated, which gives visual indication of low insulation values by the glow of a neon lamp used in conjunction with resistances which determine the voltage across the lamp. This instrument can be used on d.c. or a.c. circuits up to 500 V, and the effects of the capacity of the circuit on a.c. supply can be compensated by adjustment of resistances within the instrument. One instrument lead is connected to the supply and one to the insulation to be tested, and the instrument can be connected across one pole of the main switch on either d.c. or a.c. circuits.

There will, no doubt, be an increasing tendency to install earth leakage indicators or protective devices on smaller subcircuits, and earth leakage trips can now be obtained for small power installations. The opening of the circuit when an appreciable leakage has begun is of great importance, not only as a safeguard for the plant but for human safety. In many cases, however, overload trips are not sufficiently fast in operation or sufficiently sensitive to prevent burning of insulation before clearing the circuit.

The value of devices for testing insulation before each application of supply pressure is that dangerously low values of insulation can be noticed before the pressure is switched on, and remedial measures can be taken which may save a rewind or prevent the leakage increasing during the running period to a value which will shut down the plant or process and thus cause heavy consequential loss.

The Next President of the I.E.E.

MEMBERS of our profession who received their electrical training at Liverpool University or at Finsbury Technical College will have heard with more than ordinary pleasure of the I.E.E. Council's choice of President for the next session. Their pleasure will be fully shared by those who, though they have not had the privilege of coming under the inspiring influence of Professor Marchant at the outset of their careers, have been associated with him in later life.

Early Work

Edgar Walford Marchant was born in 1876 and was educated at University School, Hastings, and the City and Guilds Engineering College, South Kensington. He early displayed those talents that were to bring him to the front as an electrical scientist and became an Institution Scholar and a Siemens Medallist; he then graduated with first-class honours in physics and honours in mathematics in the London B.Sc. examination. Later he received his doctorate.

He was fortunate in an opportunity that came to him to work with the late W. Duddell on the oscillograph at the Central Technical College, South Kensington, and published, jointly with Duddell, an important paper on "The Alternate-current Arc," at which a demonstration with an oscillograph was given for the first time. Professor Marchant then accepted an appointment as superintendent of Lord Blythwood's laboratory and workshop at Renfrew, N.B., a position which he held from 1897 to 1900, when he became lecturer at Finsbury Technical College under the late Silvanus Thompson.

[*Lafayette.*

Professor E. W. Marchant, D.Sc.

Liverpool University

A year later he began his connection with Liverpool which has remained unbroken up to the present time. For the first two years he was Lecturer in Electrotechnics; then, when the late David Jardine founded in 1903 the Chair of Electrical Engineering in the University of Liverpool he was appointed as professor.

The building and equipment of electrical laboratories for a modern university that can claim to meet the academic needs of the age is in itself an engineering achievement of some magnitude. The laboratories at Liverpool University were constructed at a cost of £25,000, and Professor Marchant was responsible for and supervised the whole of the works.

During the war he played an active part in combating the submarine menace, being a member of the Lancashire Anti-Submarine Committee; he was also a prominent member of the International Radio-Telegraph Committee.

Published Papers

Professor Marchant has published many papers on a variety of electrical engineering subjects. Among the best known are those relating to the measurement of the strength of wireless signals, the Heaviside layer, and the transmission of power, the latter including "Transient Currents in Electrical Supply Systems," "Transmission of Power at High Voltages," and "The Economic Aspect of the Transmission of Electrical Energy."

Contributions to the *Proceedings* of the Royal Society comprise "Behaviour of Iron at High Frequencies," "The Eddy Currents produced in Metal Plates by Alternating Fields," and papers on other scientific subjects such as "The Absorption of X-Rays with Aqueous Solutions of Metallic Salts" and "The Echelon Spectroscope." He has written, in conjunction with Dr. J. L. Miller, on "The Methods of Detecting Flaws in Metal Plates" and recently on "A New Type of Portable String Galvanometer," for which he was awarded the B.O.I.M.A. Prize by the Institute of Physics. Last, though certainly not least, Professor Marchant will be remembered for his Kelvin Lecture in 1929.

Ever since the beginning of his connection with the I.E.E. in 1898, Professor Marchant has taken a keen interest in its work. He was chairman of the North-Western Centre from 1914 to 1916, and was the first chairman of the Liverpool Sub-Centre, which later became the Mersey and North Wales (Liverpool) Centre, of which he was chairman in 1929-30.

He was elected as an ordinary member of Council in 1915 and served on it for six years, during the last three of which he was a vice-president. He has taken a leading part in the educational work of the I.E.E., being an original member and now chairman of the Joint Committee of the I.E.E. and the Board of Education for the issue of National Certificates in electrical engineering. He has also acted as chairman of the Scholarships Committee and the Examinations Committee on several occasions.

We desire to offer Professor Marchant our congratulations on his being called upon to fill the premier position in our profession.

The I.E.E. in Yorkshire

YORKSHIRE is reputed to be the heart of industrial England; but it is not so generally appreciated that it is an extremely pleasant place, rich in historical associations and possessing all types of scenery.

The application of electric power to colliery operations is widespread and will increase so long as labour represents so large a percentage of the total cost of coal-getting. The aggregate h.p. of electric motors installed in South Yorkshire is 115,000 above and 63,000 below ground, the respective figures for West Yorkshire being 36,000 and 31,000 h.p.

The history of electricity supply around the North-Midland Centre (the choice of which for this year's summer tour of the Institution of Electrical Engineers is much appreciated by the 700 local members, it being several years overdue) is a record of concurrent development of municipal and company undertakings. Under the Central Electricity Board's Mid-East England scheme five base-load generating stations are scheduled to reach a total installed capacity of 620,000 kW by the winter of 1940-41. This scheme covers 7,546 sq. miles with a population of five millions and has involved the construction of 525 miles of overhead transmission lines and the erection of 3,993 towers.

The First Primary Sub-station

At Kirkstall, the first place of call on Tuesday after an hour's motor coach drive from headquarters at Harrogate, *via* Pannal and Harewood (castle *circa* 1,300 A.D. and the Princess Royal's residence), is the first of the twelve primary C.E.B. sub-stations to be made alive in the Mid-East England area. It is of the 132-kV, three-switch, low extensible type with 80,000 kVA of transformers. The control system of the area will be housed in a building adjoining the Board's offices in Leeds.

This city's electricity undertaking, of which Mr. C. Nelson Hefford is manager, has a generating capacity of 117,000 kW and a maximum load of 69,800 kW. During the year 1931-32 the energy sold amounted to 152 million kWh. The municipal area of supply is 76 sq. miles with a population of 482,790 and some 110,000 consumers are connected to the mains, of whom 42,000 have availed themselves of assisted wiring.

The new power station at Kirkstall was fully described and illustrated in our issue of March 27th, 1931, and the Ferguson Pailin switchgear in our January 15th, 1932, issue. It will eventually accommodate 150,000 kW of plant. At present it contains three boiler units, supplied by International Combustion, Ltd., each of 160,000 lb. per hour evaporative capacity at 490 lb. per sq. in. pressure, burning pulverised coal and supplying steam to two 25,000-kW, 11-kV, B.T.-H. turbo-alternators.

The Afternoon's Programme

At noon the party was divided. One group returned by road direct to Harrogate for luncheon and an excursion *via* Ripley to Fountains Abbey, inspecting Fountains Hall, which was built in 1597 of stone obtained from the ruins of the Abbey. After tea there was a two-mile walk through Studley Park. The party returned to Harrogate through Ripon market place, passing the Wakeman's House and Cathedral.

Meanwhile the other contingent had proceeded direct from Kirkstall to Huddersfield, an hour's drive, where Messrs. Hopkinsons, Ltd., were the hosts at luncheon in the Masonic Hall. Mr. Robert A. Hopkinson presided. The Mayor of Halifax (Ald. T. Shires), welcomed the visitors and Sir Archibald Page, deputising for the president, returned thanks for the company's hospitality.

Departing from the Britannia works about mid-afternoon, a trip through Brighouse and Queensbury took the party over Clews Moor; thence through Denholme, Cullingworth Moor, Keighley, Steeton, Rombalds Moor and Addingham to Bolton Bridge at Wharfedale, where tea was served. The homeward drive was by way of Blubberhouses Moor, passing the Leeds Corporation reservoirs.

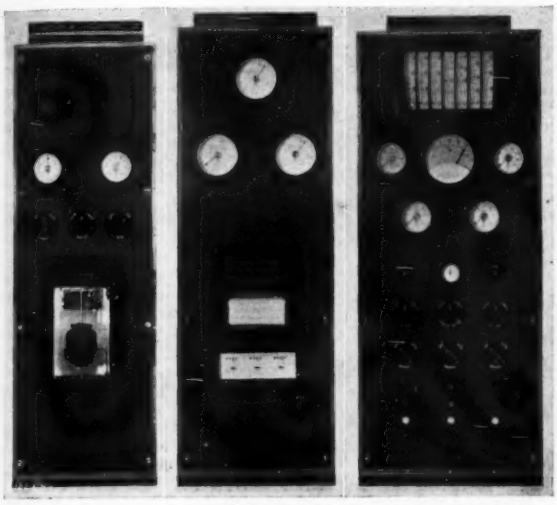
A civic reception by the Mayor of Harrogate (Ald. A. Lambert Foster) and dancing brought the day's programme to a close, in weather just suited to the occasion, fine and not too warm.

Automatic Combustion Control

The "Kent" electrical system

LAST week in our article on the Hackney extension we described the salient features of the "Kent" method of electrical automatic combustion control that has been adopted in conjunction with the Simon-Carves stoker-fired boilers. This is the first occasion on which the system has been applied to power-station operation and the further details given below have now become available.

The main function of the system is to govern combustion in a group of boilers in strict accordance with the demand for steam. It is designed to detect changes of load and steam pressure immediately, and to supply and maintain the correct ratio of fuel and air to meet the load conditions. It is claimed that it enables any boiler to be operated at its most efficient combustion point and will maintain any desired load distribution in the group. Means are provided to ensure an absence of "hunting." As it is an electrical system it offers the conveniences of centralised control, and allows for immediate change over from automatic to hand control. In the Hackney installation, the control-room operator has the choice of either method, but in the boiler house provision is made to change over to manual operation if necessary.



The master control panel (left), the steam-flow meter panel, and the boiler control panel

The Master Controller

The rate of combustion for all boilers is maintained by a master controller, in which is an oil-filled chamber connected to the steam range; a piston in this chamber is rotated by an electric motor at a rate to overcome frictional resistance to the subsequent vertical movement of the piston caused by variation in the steam pressure. The movement of the piston operates the central arm of the first contact mechanism, causing either the upper or the lower contacts to be made first sending, at definite intervals, relay-operated signals for "more" or "less" control as may be required; the relay is worked by a camshaft gear-driven by a motor. This sequence registers the deviation of steam pressure from the normal.

The rate of pressure change is measured by a second contact device (brought into use by means of a clutch operated during each measuring period), which varies the contact period as the steam conditions require. If the rate of deviation of the pressure from normal is greater than that of the response calculated to be given by the amount (or "deviation" signal) from the first contact mechanism a longer period of contact is allowed by the second contact device. If the pressure has dropped but is rapidly rising the first contact demands "more" control, but this demand is cancelled by the second device, which has already measured its rate of return and gives varying periods of contact for "less" control until pressure becomes normal. The signals are transmitted by two mercury relays.

Furnace-pressure Regulation

When balanced draught is employed a furnace pressure controller is required for each boiler. This consists of a bell suspended in oil and attached by springs to fixed plates mounted on angle brackets; a vertical rod connects the centre of the bell to a lever which, in turn, rotates a spindle attached to the contact arm. Deviations from the desired conditions are conveyed to the bottom of the float chamber by means of a pipe connected to the combustion chamber, and the float is lowered or raised in proportion to the increase or decrease of suction, contact being made for more or less control as required. The sensitivity can be adjusted to 0.002 in. w.g. This controller is not subject to any time interval in its measurement and control period, and operates continuously when necessary.

For stoker-fired boilers it is assumed that grate speed provides a close enough indication of fuel supply. A small amount of hand adjustment is necessary to deal with varying calorific values of fuel or excessive moisture content.

The fuel-air ratio controller consists of a flat chamber in which are two bells suspended in oil and attached by springs to fixed points. The differential pressure, given by the draught loss between two points in the air or gas system, is brought by piping to the smaller bell. A small fan driven by the variable speed stoker motor delivers the pressure resulting from the stoker speed to the large bell, from which a vertical rod is connected to a lever attached to a spindle forming part of the link mechanism, which joins the two bells *via* a cam-operated spindle connected to a rod on the smaller. An alteration in the air supply moves the small bell. The movement is transmitted through the link mechanism by the cam; the central contact arm is deflected, causing a signal to be given for more or less fuel. Hand adjustment is provided by a small electric clock movement in the link mechanism, operated by push buttons from the control room.

Damper Operation

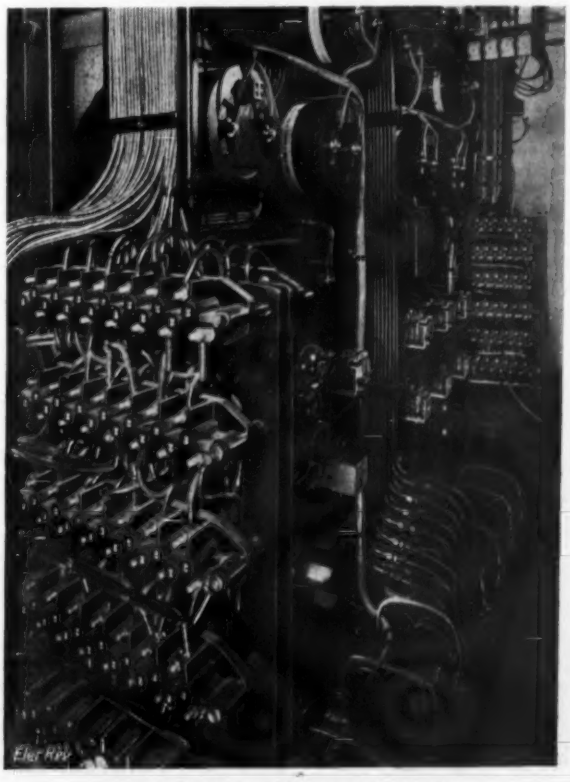
The damper gear box is operated by two motors driving worm gearing on opposite sides of a differential. More or less control is given according to the direction of rotation of the damper spindle; this is shaft-driven through spur gearing, to which is connected a friction clutch that terminates in another spindle connected to the hand-operated mechanism.

When the gear box is automatically controlled (which occurs only at light loads when the fan motor is running at its lowest speed) the friction clutch allows the spindle to rotate and gives remote indication of the damper position. The clutch mechanism permits hand operation of the dampers without disconnection at the gear box. When the damper of the induced-draught fan is fully open, the control signals are transmitted to the fan-motor speed regulator.

The speed of the i.d. and f.d. fans is controlled by solenoid operated shunt regulators giving 200 contact points for a range of from 550 to 920 r.p.m. Signals from the master controller are received by a vernier regulator, one revolution of which moves the main regulator to the next contact. Limit switches transfer the signals at the lowest speed to the damper gear box.

The solenoid-operated speed control of the stoker motors has 25 contacts for a range of from 400 to 1,200 r.p.m. Eight-to-one gearing allows the speed range to be traversed in synchronism with the i.d. equipments.

The control room equipment at Hackney enables the combustion conditions to be kept under continuous supervision. Thus, temperatures of steam, air, and gas, as well as the steam pressure and flow, CO_2, and other ordinary measurements, may be observed from point to point in the cycle of operations.



The back of the boiler control panels

Harrow Rectifier Equipment

Plant which is automatically controlled from a remote sub-station

AN interesting example of an automatically operated Peebles-Brown Poveri mercury-arc rectifier is the equipment recently installed at the College Road sub-station of the Harrow Electric Light and Power Co., Ltd.

The sub-station is situated in a residential district and at present contains one rectifier. Transformer cubicles form one side of the building and are separated from the sub-station proper by a brick partition, access being from outside only. The relatively small weight of the rectifier has made special foundations or reinforcing unnecessary. The sub-station is ventilated by louvres fitted at the bottom of the main entrance doors and the air, before passing to the outside of the building, is expelled over the top of the transformer cubicles by an outlet duct from the recooler, this arrangement creating a circulation of air which assists in the cooling of the transformers.

1,000-kW rectifier and recooler equipment (with screens removed)

Adequate Safety Margin

The rectifier is of the metal cylinder type with twelve anodes and a normal rating of 2,100 A at 450/500 V d.c. It is designed to withstand overloads of 25 per cent. for two hours and 100 per cent. for 15 seconds. The preliminary vacuum pump, driven by a small low-speed a.c. motor, is separately mounted upon an insulated base, but it could be mounted without difficulty direct on the rectifier cylinder, thus making a self-contained unit. The motor is insulated from the base-plate and an insulated coupling is provided. The high vacuum pump is mounted direct on the rectifier immediately above the preliminary vacuum pump set.

The cylinder is composed of fabricated steel plates of special grade, welded and specially treated to remove all dirt. The vacuum seals are of the mercury type, which enables efficient joints to be made with normal tension of the fixing bolts.

Should any joint develop a leak, the fault will be immediately shown by the sinking of the mercury in the indicator gauge, one of which is fitted to each joint. Moreover, while the leak persists, only mercury can gain access to the arc chamber and this is of small consequence since it merely adds to the amount of mercury in active use. The twelve anodes are carried by the steel plate top half of the rectifier, which can easily be removed to permit of inspection. The complete rectifier stands upon insulators mounted direct on the floor.

Strips of copper form the connections to the anodes and are brought out to a terminal board mounted on the outside of the top half of the rectifier for connecting to the cables from the secondary winding of the transformer. Connection to the cathode, or positive, terminal is also made by copper strip.

Excitation and Cooling

Ignition and excitation current is supplied by a Peebles 7-kVA, 3-phase, 50-cycle, 11,000/220-volt, oil-immersed transformer, which also supplies all the auxiliaries, and it is connected to the incoming feeder by an oil-immersed switch-fuse. Two excitation anodes are provided; they ensure steady d.c. voltage, even at no-load, and, as they are continuously energised, the cathode spot is maintained quite independently of the magnitude of the load.

Internal heaters are not fitted; provided the vacuum is of the correct value the rectifier may be started up cold and put on load without any delay. The high vacuum pump operates continuously, whether the rectifier is in operation or not.

The rectifier is water cooled by a Heenan & Froude recooler situated adjacent to the rectifier. This takes the form of a motor-operated fan-cooled radiator and motor-driven water circulating pumps, the complete equipment being mounted on insulators. Two separate cooling systems are provided, one for the rectifier and the other for the condensation of the mercury in the high vacuum pump, the same water being used continuously.

D.c. distribution is on the three-wire system and a Peebles rotating balancer set is provided, capable of dealing with 300 A out-of-balance current. This set, which runs at 500 r.p.m., consists of two protected type d.c. shunt wound machines directly connected and mounted on a combination bedplate. It is automatically controlled by solenoid operated circuit breakers and contactors and the sequence of operations is such that the balancer is started immediately the rectifier main circuit breaker closes. The main and balancer circuit breakers are interlocked, so that when the rectifier shuts down the balancer is automatically tripped out.

A Peebles oil-immersed transformer operates in conjunction with the rectifier and is supplied with a 3-phase 50-cycle current at 11,000 V. It is provided with motor-operated on-load tap changing gear to give the necessary d.c. voltage variation. As previously mentioned, it is situated in a separate cubicle along with the auxiliary transformer and absorption choke coils. The secondary windings are double six-phase connected and the cables from the twelve phases are carried through an aperture in the brick wall partition directly to the rectifier terminal board. The negative circuit of the rectifier originates at two absorption choke coils which are connected to the four neutral points of the main transformer secondary winding, an isolating switch being provided at the negative bus bar. The use of absorption choke coils (protected by patent) in the manner indicated has the effect of considerably reducing the volt-ampère rating of the main transformer and, moreover, the d.c. voltage drop from approximately no load to full load to 5 per cent. The secondary windings are protected against voltage surges by horngap arrestors.

Rectifier Control

The rectifier is remote controlled from the main sub-station situated about a mile distant, and operates in parallel with rotating convertors in that station. The remote-control apparatus is similar in both cases.

The 11,000-volt a.c. incoming supply is received at a Reyrolle motor-operated oil switch provided with overload protection with instantaneous and inverse time limit characteristics. The automatic control panel performs the starting and shutting down operations and provides for the complete protection of the plant, after the starting impulse has been given from the remote end. This panel is fitted with a vacuum gauge, main transformer step switch indicator, switches for changing over to manual control, and push buttons for (*a*) start up; (*b*) shut down; (*c*) raise volts; (*d*) lower volts. Remote meters indicate load and voltage conditions. Signals also indicate "plant running," "shut down" and "recooler fault."

The starting impulse is given by depressing a push button, which actuates relays for closing the h.p. oil switch, thereby energising the main transformer and the relay for closing the d.c. circuit breaker, which is fitted with a time lag to ensure that it cannot close before the oil switch. By means of auxiliary contacts the ignition and excitation apparatus is energised simultaneously with the closing of the oil switch.

Remote control of the motor-operated tap changing gear on the main transformer enables the operator to achieve good paralleling; voltage variation of 16 per cent. can be obtained and the 66 steps provided give a very smooth control range. The h.p. oil switch is interlocked with the step switch and will be immediately tripped in the event of the step switch remaining in an intermediate position between two tappings.

Vacuum Maintenance

Correct vacuum is automatically maintained by contacts on the gauge, the needle of which controls the starting and shutting down of the preliminary pump. This needle will also cause a "lock out" of the rectifier should the vacuum be too low for satisfactory operation. In the event of the temperature of the rectifier exceeding a predetermined limit, it will be shut down by means of a contact thermometer mounted on the anode plate.

Should the h.p. oil switch and d.c. circuit breakers be tripped, a second attempt will be made to close them before the plant is shut down, the appropriate signal being then given at the main sub-station. Failure of the recooler fan or pump motors is also signalled to the main sub-station, simultaneously causing the relay for the vacuum pumps to open the heating plate circuit of the high vacuum pump. Immediately the fault is removed the heating plate circuit is again made.

The d.c. feeder switchboards were made by Bertram Thomas.

Relay Time Lags. By G. W. Stubbings, B.Sc., A.M.I.E.E.

The need for a linear time-current characteristic

THE induction overcurrent relay was once used largely for obtaining discriminating protection, and even at the present time it is employed in conjunction with more modern systems as a standby should the principal relays fail.

Early types of induction overcurrent relays comprised a shaded pole magnet, which communicated a driving torque to a pivoted disc rotating in the field of a permanent magnet, to which was attached the trip circuit contacts of the relay. The movement had a variable static control consisting of a weight, the leverage of which was adjustable. The amount of rotation of the disc necessary to close the trip

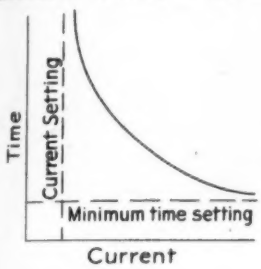


Fig. 1

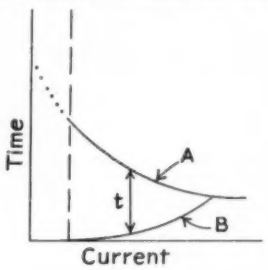


Fig. 2

A. Characteristic without spring coupling: B. Bending of zero time axis due to spring coupling: C. Resultant time lag.

circuit contacts was also capable of variation. The elementary theory of this device is that, as the driving torque depends upon the square of the current in the relay coil, and the dynamic braking torque depends upon the speed, this speed will depend upon the square of the current, and the time required for the current to flow before the trip circuit contacts close will depend upon the inverse square of this current. Thus, the time current characteristic should be asymptotic to the axis of zero time.

Two circumstances modify this theory. First, due to magnetic saturation, the flux in the relay magnet does not increase proportionately with the current in the winding, nor, when the relay is used in conjunction with a current transformer, does the relay current remain proportional to the primary current at heavy overloads. Secondly, since the disc of the relay movement rotates in the field which gives rise to the driving torque, this field will set up a dynamic braking torque which is proportional both to the speed and to the square of the current. This self-braking torque is small with moderate overloads, but as the overload current increases, it swamps the permanent magnet torque and determines the speed of the movement.

In these conditions, therefore, the driving torque and the braking torque are both derived from the relay current, and the speed becomes constant and does not increase for any further increase of the relay current. Due to the combined effects of magnetic saturation and the self-braking torque, the time current characteristic of an overcurrent relay is asymptotic, not to the axis of zero current, but to a line lying above it at a distance depending upon the amount of rotation required to close the relay trip contacts. This feature gave to the induction relay a minimum time lag that could be varied by adjusting the amount of travel of the movement required to close the trip contacts.

Defects of Existing Types

The constant minimum time lag of the induction relay was once regarded as an outstanding advantage. The relay certainly gives reliable time discrimination with short-circuit currents, but it suffers from the grave defect that, if a system of graded time lags is used, the relays nearest to the power station must be set with the greatest time lags, so that the severest short circuits remain the longest on the system. If, for instance, three stages of time lags are used, the minimum time lags of the feeder relays in the power station can hardly be less than one second, but a short-circuit of the maximum severity adjacent to the power station should certainly be cleared practically instantaneously.

This form of characteristic of the induction relay is quite unsuitable for short-circuit protection. The steep portion of the curve, near the current setting value, is of very little use; in this zone, the operating torque is small, and the current at which the movement begins to creep is indefinite. The relatively long time lags in this zone are not required, nor can discrimination be relied upon at very low speeds. The whole of the so-called inverse portion of the curve is inefficient in that the decrease in the time lag does not bear a constant ratio to the increase in the operating current. The tendency has been in the past to make use of the flat part of the characteristic only, so that the relay becomes virtually one of the constant time-lag type. The need has been felt in recent times for a relay with a linear time-current characteristic having a definite starting current, the time lag vanishing with a determinate value of the operating current.

A Modified Design

A new design of overcurrent relay, with a linear characteristic, has recently been evolved in America. To obtain this characteristic it is necessary to prevent the rising and flattening of the curve whereby it becomes asymptotic to the ordinate of the setting current and to the line representing the definite time lag. To do away with the rising portion of the curve, the usual weight or spring restraining torque is dispensed with, and the force exerted by the driving element is assisted by the action of a spring. For the purpose of preventing the operation of the relay with no current in its windings, the driving element is locked in the normal position, and an auxiliary element unlocks the driving mechanism when the relay current attains the desired setting value.

The effect of this modification is to shift the normal curve shown in fig. 1 to the left, as shown in fig. 2, the dotted portion to the left of the vertical, representing the setting value, being rendered nugatory by the action of the locking element. The starting current is now perfectly definite, and, once it is reached, the relay moves at the normal speed.

In order to eliminate the flattening of the characteristic curve at heavy overloads, a further modification is required. The self-braking torque inherent in the ordinary type of relay is avoided by the use of a solenoid driving element. This element is not rigidly connected to the eddy-current brake disc, as in the older type of relay, but acts on this disc through a spring coupling.

The effect of this spring coupling is very important. If the overload is relatively small the force exerted by the driving element will be small, and the brake disc will commence to rotate as the driving member starts to move. With heavy overloads the driving member will progress freely, without dynamic braking against the reaction of the coupling spring, till the dynamic torque set up by the brake corresponds to the force exerted by the driving element. For a certain value of the current the movement will cover, without braking restraint, the whole of the distance required to close the trip contacts, and the action of the relay will be practically instantaneous. The effect of the spring coupling of the brake disc is to cause the axis of zero time in the graph of the characteristic to bend upwards to meet the curve in the manner shown in fig. 2. The effect of the two modifications which have been described is to give a characteristic of the form shown in fig. 3, which is approximately linear.

Independent Adjustments

A relay of this kind allows of three independent adjustments. Alteration of the ampère turns in the unlocking member will vary the value of the starting current of the relay. Alteration of the travel of the movement required to close the trip contacts will have the effect of shifting the charac-

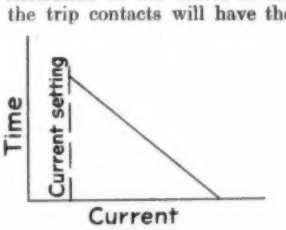


Fig. 3

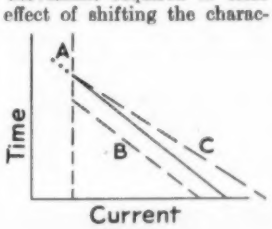


Fig. 4

teristic curve to the right or the left, without modifying its slope, while an alteration of the ampère turns on the driving solenoid will vary the slope of the curve without altering the value of the starting current.

These three variable settings are shown in fig. 4. A shows the extension of the characteristic to the left which results in making the unlocking element more sensitive, B the shift of the curve due to the alteration of the travel required to close the trip contacts, and C the alteration of the slope by variation of the sensitivity of the driving member.

Electrical Mine Shotfiring Apparatus

The Secretary for Mines announces that, in pursuance of the Explosive in Coal Mines (Electrical Shotfiring Apparatus) Order, 1932, the Davis dry battery (1932) low-voltage exploder manufactured by Messrs. John Davis & Son (Derby), Ltd., has been approved for use in all coal mines to which Part II of the Explosives in Coal Mines Order of the 1st September, 1913, applies.

"Key" Fibre Ducts

WHEN laying out the wiring systems of new buildings of modern fireproof construction an endeavour is made to provide, not only for the initial requirements, but also for future additions and modifications so far as they can be foreseen. These are really unknown factors, since the actual subdivision of floors from time to time to suit tenants' convenience is not usually determinable beforehand.

Flexibility of the distribution systems installed in large buildings is therefore an essential requirement if the disturbance of and damage to floors and wall decorations which every addition to and change of existing outlet points involves are to be avoided, together with the unsightly expedients sometimes resorted to.

In several large buildings erected recently networks of fibre ducts have been laid in the floor-fill, according to the system of the Key Engineering Co., Ltd., to form grids throughout the usable floor spaces. Double lines of ducts are used, one to contain lighting, heating, and power cables, and the other for telephone, bell, and similar wires. They are so laid with parelles from 5 to 8 ft. apart that each desk, however it may be arranged or the rentable space allocated, is self-contained with service ducts under it which can be tapped easily and neatly as and when required at any time during the life of the building.

Neat and Economical

Wires are hidden from view; draw-in box covers and outlet fittings are so made that the flooring is not damaged when removing box covers or making outlet connections. All future development is provided for without disfigurement and at minimum cost. No joints or tees are made underfloor either in the duct or draw-in boxes, and all points are looped in.

The system is economical because no cables are laid in the ducts until required, and no outlet is made until the floor is completed. The whole system is water-tight and the section of the fibre duct is semi-circular, and the maximum useful area is obtained for the minimum depth of floor fill.

The fibre conduit showing alternate dead ends

The duct is made of fibrous material impregnated with a preservative bituminous compound; consequently breathing and condensation are minimised and the duct cannot ignite through cable breakdowns. It is very quick and easy to lay, no skilled labour being required, and the expense of establishing additional outlets is negligible. The duct cannot corrode and therefore has a long life.

Finished desk outlets

The ducts have open bottoms and are laid on a concrete pad formed on the floor slab, the pad being covered with a strip of asbestos bitumen sheeting. The metal draw-in boxes are set to floor level by elevating screws, and their covers are recessed to take various floor coverings, so being hardly visible. Baffles maintain separate compartments for electrical and communication wiring within the boxes, the corners of which can be drilled to take steel conduit.

The outlet procedure is to cut a circular hole through the flooring and duct with a special tool, so fashioned as to avoid damaging any wires already in the duct. A metal outlet is then screwed into the top of the duct (cutting its own thread) flush with floor level. Cement grouting is poured in and the covering flange or other type of outlet screwed in.

Typical Installations

Among typical installations that at Martin's Bank, Ltd., Liverpool, is a 2¼ in. x 4¼ in. double compartment system with a floor fill 4¼ in. thick. The ducts are laid on a level concrete runway superimposed on the floor slab at 5 ft. centres; over 50,000 ft. was installed. Headers lead from control rooms on each floor via passages, where possible, feeding grids covering the floor space, which totals about seven acres. Round-topped boxes are used with covers recessed for linoleum, and are adjustable both as to height and level. The principle on which the lighting is arranged is to give sufficient general overhead illumination with provision for individual desk lights. The overhead lighting system and the underfloor duct system are interconnected.

Similar installations have been carried out in the Jantzen Knitting Mills, Brentford; two of Lloyds banks in Liverpool; and the Canada Life Assurance Co.'s new London building.

A New Radio Receiver

THE first of the range of mains driven broadcast radio receivers for next season is to be released to the trade by the General Electric Co., Ltd., on June 6th.

It is an inlaid walnut table instrument, 200/260 V, d.c. mains operated, and will be known as the "Nomad" model.

The receiver has been designed with three tuned circuits, and employs two screened grid h.f. stages feeding a screen grid detector. The aerial is loosely coupled to the first grid circuit, and transformer coupling is used throughout. The screened grid detector is resistance-capacity-transformer coupled to the pentode valve, which feeds the moving-coil loudspeaker. The new pattern "Osram" indirectly heated d.c. valves with ¼A. heaters are fitted throughout, D.S.B. and D.S. type screened grid valves being employed in the first and second h.f. stages, respectively, and a D.S.B. screen grid valve as detector. In each case the valves are metallised. The output valve is a D.P.T. power pentode. The valves are run in series and a 210-V, 75-W lamp, which also serves to give illumination of the tuning dial, is used to reduce the supply voltage.

The "Nomad" receiver

The mains-energised coil-driven loudspeaker which is fitted in this instrument is an entirely new production of the G.E.C. The objectionable 9,000-cycle whistles caused by stations heterodyning are eliminated by the inclusion of a heterodyne filter in the anode circuit of the output valve. There is also freedom from mains hum by virtue of the elaborate smoothing and decoupling provided.

The operation of the instrument is governed by three controls, conveniently centralised on the front panel. The first knob has three positions for long-wave, medium-wave, and gramophone reproduction. The central control operates the triple-ganged tuning condenser and a corresponding illuminated scale provided with direct wavelength calibration. The third adjustment is a dual acting volume control, which, in its minimum position, automatically switches off and isolates the receiver from the mains. An additional refinement is a local-distant switch, which can be operated to reduce excessive signal strength without any loss of quality.

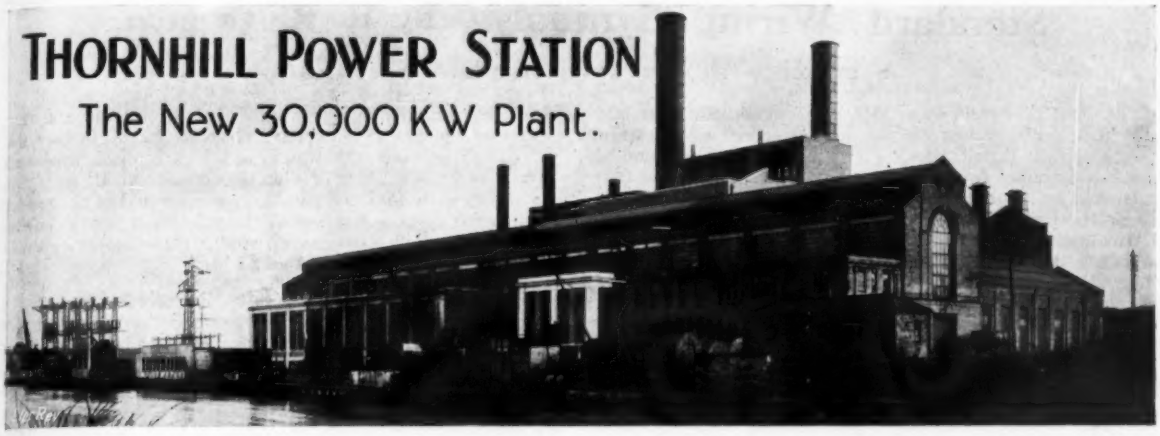
Alternative aerial sockets are provided to adjust selectivity to individual requirements, and for the reception of powerful stations a non-directional plate-aerial which is built into the receiver will be found sufficient.

Connection can be made through the back of the receiver for an extra loudspeaker and pick-up; the latter may be left permanently in circuit and brought into use by a turn of the range switch on the front panel, which automatically breaks the grid circuit of the detector valve and adjusts the bias to enable the valve to function as a low-frequency amplifier. As a measure of safety, it has been made impossible for any part of the interior of the receiver to be touched without first disconnecting the mains, but when this has been done the back panel is readily removable to provide access to the all-metal chassis.

The consumption is approximately 75 W (varying according to the supply). The overall dimensions are 13 by 18 by 19½ in. high.

THORNHILL POWER STATION

The New 30,000 KW Plant.



ON Wednesday last members of the Institution of Electrical Engineers visited the Thornhill power station of the Yorkshire Electric Power Co.

The main item of interest was the 30,000-kW 3,000-r.p.m. turbo-alternator, together with its four boilers, switchgear and auxiliaries which have just been completed, bringing the station capacity up to 67,000 kW.

The new turbine is a two-cylinder machine, operating with steam at 415 lb. per sq. in. and 750° F.; the h.p. cylinder contains eighteen impulse stages and each half of the divided l.p. cylinder nine reaction stages. The shaft and wheels of the h.p. rotor are machined from a solid forging, and the blades contain from 3 to 5 per cent. of nickel; the l.p. rotor wheels

One of the new boilers

are shrunk on the shaft and are fitted with m.s. blades with manganese steel inserts where they are subject to erosion. Steam is bled from four stages to raise the temperature of the feed condensate to 350° F.

Relays limit the steam pressure in the event of the area through the nozzles or blading being accidentally reduced; a similar relay prevents undue back pressure, so far as back pressure is a function of the rate of steam supply, by reducing the main steam supply. No atmospheric exhaust main is provided, but a relief valve (such as has been in use in the company's Ferrybridge power station for several years) is fitted to the exhaust of the h.p. cylinder to prevent damage should the relay fail to operate.

The Alternator and Condensers

The 10,500-V 50-cycle alternator is rated at 32,350 kVA. Air for the cooling system is circulated by a single-impeller turbo-blower, as at Ferrybridge, the speeds of the blower and the exciter being reduced by gearing to 1,500 r.p.m.

A single surface condenser is suspended from the exhaust branch of the l.p. turbine, and steam-jet air pumps and electrically driven vertical condensate pumps are installed in duplicate. Circulating water is drawn from the river through a rotary screen by two vertical slow-speed centrifugal pumps placed below water level; one of these (30,000 g.p.m.) is direct-driven by an induction motor and the other (15,000 g.p.m.) is gear-driven by a vertical steam turbine.

The four new boilers have evaporative capacities of 100,000 lb. per hr. each with steam conditions of 450 lb. per sq. in. and 750° F. They are fitted with plate-type air heaters, balanced draught travelling-grate stokers with forced and induced-draught fans. Each pair of boilers has a single steel-plate fire-brick-lined chimney 184-ft. high from the firing floor and 12½-in. internal diameter at the top.

The electrically operated auxiliaries are supplied at 400 V through local transformers controlled by iron-clad switches.

The greater portion of the output from Thornhill is distributed at the pressure of generation but is interconnected with the company's 33-kV system; there is a 66-kV interconnecting main between Thornhill, Ferrybridge and Barugh (selected) power stations at 66 kV.

High-voltage Switchgear

The switchgear is of the iron-clad draw-out type with a rupturing capacity of 500,000 kVA at 11.5 kV and of 800,000 kVA at 33 kV. Interconnection between the 11 kV and 33 kV systems is through duplicate banks of self-cooled 20,000-kVA transformers, and between the 33 kV and 66 kV systems through a 30,000-kVA forced cooled transformer. Connections with the system of the Central Electricity Board and for local supplies are made with the 33-kV bus bars.

The principal contractors for the extension were: Messrs. G. & J. Weir, Ltd., condensing plant; English Electric Co., Ltd., turbo-alternator; Mitchell Conveyor and Transporter Co., Ltd., buildings and structural steel; F. W. Brackett & Co., Ltd., c.w. screens; Sir Wm. Arrol & Co., Ltd., overhead crane; Lancashire Dynamo & Crypto, Ltd., and Crompton, Parkinson, Ltd., induction motors; W. H. Allen Sons & Co., Ltd., c.w. pumps; Mather & Platt, Ltd., steam-turbine feed pump; Stirling Boiler Co., boilers; Diamond Blower Co., Ltd., soot blowers; Stewarts & Lloyds, Ltd., steam and feed pipes; Robert Dempster & Sons, Ltd., coal chutes, ash hoppers, and general steelwork; J. Blakeborough & Sons, Ltd., c.w., l.p.-steam and condensate valves; Newton, Chambers & Co., Ltd., water storage and surge tanks; Hopkinsons, Ltd., boiler mountings and h.p. steam valves; Wm. Wadsworth & Sons, Ltd., boiler house lift; Stanton Ironworks Co., Ltd., c.w. pipework; A. Reyrolle & Co., Ltd., 33-kV and 11-kV switchgear; Allen West & Co., Ltd., 400-V switchgear; Ferranti, Ltd., 20,000-kVA transformer; British Thomson-Houston Co., Ltd., 33-kV and 11-kV reactors; C. E. Binns, lagging; Hathorn Davey & Co., Ltd., motor-driven feed pump; D. Ingram & Co., steelwork; Howden Ljungstrom, Ltd., i.d. and f.d. fans; Heenan & Froude, Ltd., air cooler.

The 30,000-kW steam turbo-alternator

Standard Wiring Symbols. By H. R. Taunton

A criticism of the new Standard Specification

STANDARD Specification 447/1932, "British Standard Graphical Symbols for use in connection with Interior Electrical Installations," just published, is a selection of symbols extracted from a fuller list now in preparation. It is intended, as its title implies, for the use of those interested in electrical wiring work.

An authoritative code has long been wanted. Hitherto every architect, consultant and contractor has used his own, often illogical, ill-designed and inconstant, and, since it could only by chance agree on an occasional symbol used by another, always unintelligible without a key. A key will still be necessary with the B.E.S.A. code, for the 50 symbols given in it are too many to be memorised; but it will have the great merit of being a common key, available to any who will take the trouble to use it.

Comprehensiveness a Feature

The multiplicity of symbols is perhaps the most obvious criticism to be made of the Specification; but evidently the idea has been to include every symbol from the larger list which might conceivably be needed for the marking up of wiring plans. We are given, therefore, symbols not only for lighting and power, but for bells, telephones, alarms, wireless and clocks. Even that modernity, the synchronous clock, has its symbol (7). Actually, however, a number of the symbols are regular variants, easily to be remembered. As the foreword points out, power symbols are the same as lighting ones with a doubled outline; similarly, fire alarm symbols are bell symbols with the same variation, and special purpose apparatus is distinguished from ordinary by being crossed. That reduces the fundamental symbols from 50 to 34.

Even that smaller number is too many for memory; and those that cannot easily be remembered will tend to fall into desuetude. They will be those for the apparatus less commonly marked on plans, such as telephones, alarms and clocks. Some, indeed, will be wanted so rarely that it is difficult to see why it was thought worth while reserving a special symbol for them: for instance, 36 and 37, for "public service" telephones; or even 23 and 24, main cutouts, 35, bell transformer, and 48, master clock. However, the symbols are there for the guidance of those who may have exceptional need of them.

Unnecessary Distinction

Two other dubious symbols are those for power points, ceiling and floor (2 and 4). All power points in a building must take the form either of sockets, for which other symbols are given (11, 12), or of fixed apparatus, such as radiators or motors; in which case it is the apparatus which requires a distinguishing symbol—which is given in the single case of fans (6). It may be that the intention is simply to show the position of the apparatus, leaving further definition to a schedule; but in that case why is there no symbol for a power wall point? Considerably more power apparatus is fixed to walls than to ceilings.

There are one or two other items to which symbols might usefully have been given. Nothing is suggested for a floor lighting socket, for instance. Symbols for draw-boxes are often wanted—far oftener than for master clocks!—in connection with blank conduit runs, where it is of importance to record the exact positions where wires can be drawn in at a later date. A symbol, too, for thermostats, in connection with heating installations, is one that will be increasingly in demand.

The foreword claims that wherever practicable symbols have been designed to bear some resemblance to the devices they represent, and that is generally true. It has led, indeed, to what is, in some cases, over-elaboration: symbols which are less conventional signs than pictures, calling for a needless expenditure of draughtsman's time if they are to be neatly reproduced. Take, for example, 34, bell and indicator, or 42, fire gong, entailing the drawing of two circles and a square, and two squares and a circle, respectively. A further disadvantageous result is that many of the signs are unnecessarily large. A sixteenth-inch or even the common eighth-inch plan fully marked up for a complex installation would be as crowded with symbols as a boy scout's tunic; and it would be impossible to put them all in their correct places, so losing much of the value of a properly marked plan.

Greater Simplicity Required

It would have been better to have sacrificed something of the principle of attempted resemblance in favour of a greater simplicity, even if it were wholly arbitrary, as has, in fact, been done in one or two cases: *e.g.*, 38, telephone, represented by a solid triangle. True that there are only a limited number of simple forms available, but not all of them have been used. Open and solid squares, solid circle, open triangle, cross, star: any of them would have been better than some of the complex designs adopted.

Nor has the application of the principle been always happy in other ways. The symbols 9 to 12 are much more likely to suggest the old-fashioned tumbler switch than the wall sockets they are supposed to represent; and the two for synchronous and "secondary" clocks (7 and 49) are far too much alike to be distinguishable on the average blue print. On the other hand, the signs for switches (13 to 15), which are purely conventional, are perhaps the least satisfactory of the series. The one-way switch is represented by the dot and sloping stroke commonly used in diagrams, where it is clear enough. On a plan, however, it is too uncharacteristic to be easily distinguished and, particularly against a hatched wall, might be mistaken for a slip of the draughtsman's pen. A simple cross, which is already in fairly general use for the purpose, would have been better.

A final small point. If it has been thought desirable in 32 and 46—but, curiously enough, not in 34 and 43—which all represent indicators, to leave a space "N" for the number of ways, why has not a similar provision been made in the case of the eight symbols for fuseboards and distribution boards, where the information is at least as useful? In either case, however—indicators or boards—it is better left to an accompanying schedule.

A Long-felt Want

So much by way of criticism—and that in response to the invitation of the "Note" on the inside cover of the Specification, which tells us that "suggestions for improvements, addressed to the B.S.I. . . . . will be welcomed." The rest can only be a hearty welcome for a comprehensive, useful and, above all, authoritative list of symbols. It behoves all who have occasion for such symbols to adopt them without variation, abandoning their own codes, however much they may prefer them. They may agree with some of the above criticisms, or they may have others of their own. To some of them effect may be given in later editions; but in the meantime the standardisation and uniformity offered by the present list are boons too great to be negatived by individual prejudices.

It remains to be seen how far the architects, consultants and contractors will support this step in the right direction taken by the representative organisations of the three of them. Will the consultants follow their leaders loyally and drop their own codes, some of them long established? Will all the 7,000 or 8,000 contractors in the kingdom spend one and twopence on a copy of the Specification and have its chart hung permanently in their drawing offices—if they have one? And, most doubtful of all, will the architects trouble their heads at all about the matter? It would be interesting to know what steps, if any, have been taken to bring to their individual notice the existence of Standard Specification 447/1932.

Valve and Valve-socket Specification

A STANDARD Specification governing the dimensions of radio valves and sockets essential to secure good contact and interchangeability has long been overdue. Prior to the meeting of the International Electrotechnical Commission in September, 1927, there existed two slightly divergent sets of dimensions for radio-valve bases, those adopted in Great Britain on the one hand and those adopted by the majority of the countries on the Continent of Europe on the other hand. A compromise has now been arrived at whereby complete interchangeability is secured by making a slight alteration in both sets of dimensions. This has been adopted by the British Standards Institution, with the agreement of the Radio Manufacturers' Association and the Valve Manufacturers' Association, and British Standard Specification No. 448 has now been published. It is expected to standardise eventually the solid pin for use on all valves coming within the scope of the present Specification, but in view of the large number of non-resilient sockets at present in use for four-pin valves it has been considered necessary to recognise the resilient pin as standard for these valves until such time as resilient sockets have come into general use. Copies of the Specification (No. 448-1932) may be obtained from the Publications Dept., British Standards Institution, 28, Victoria St., S.W.1, price 2s. 2d. post free.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

E.H.P. Switchgear

In your issue of to-day's date Mr. L. J. Bamber refers to Mr. H. F. Yelland's very interesting and instructive article and suggests that Mr. Yelland is wrong in leading the purchaser to believe that there is to-day "the impossibility of obtaining figures of efficiency" and "an absence of that data which forms a useful guide in the selection of other plant." Then Mr. Bamber refutes his own suggestion by advocating what are virtually "trial and error" or "hit and miss" methods of circuit breaker production (it cannot be called design) on the test bed.

When constructional engineers erect a railway bridge and the first train to use it is not plunged to destruction, they do not express the amazement appropriate to a miracle by long and loudly advertising the fact. Nor do they suggest that the bridge of competing constructional engineers should not be used, until x trains have passed simultaneously over the bridge y times at the builders' works, or, alternatively, obtained a certificate of fitness from a foreign country. Such proceedings would be met with contempt and ridicule and it is suggested that manufacturing electrical engineers who resort to such methods of competition are damaging their own profession.

Certainly there are phenomena calling for research which may wreck a circuit breaker just as the railway bridge may be wrecked by an earthquake or a troop of boy scouts marching in step. But no constructional engineer would hope to sell a 'quake-proof or scout-proof bridge at a fancy price because the civil engineering profession is old enough to have acquired good manners and, moreover, it would be difficult to frighten a railway engineer into the desired state of mind.

Circuit breakers are long past the experimental stage and switchgear manufacturers of experience and standing can, and do, design circuit breakers which perform the duties for which they are intended, with a requisite factor of safety. To the shame of British electrical engineers, manufacturers and buyers alike, circuit breakers are sent across the Atlantic to be tested by our talented and humorous cousins who have, along with their very noteworthy achievements, produced that delightfully vulgar, expressive and too often appropriate expression—"Says Which?"

May 27th, 1932. ANON.

Two batteries of small drilling machines at Ferranti's works—a good example of individual motor drive

Sydney Harbour Bridge Shocks

Prominence has been given in the Sydney (N.S.W.) daily Press to the reports of severe electric shocks received by toll collectors and motorists on the Sydney Harbour Bridge. The correspondence columns have also been used by engineers and ordinary citizens for putting forward theories to account for the phenomenon and suggestions for its elimination. Your readers may consider the following observations of interest.

The Sydney Harbour Bridge, including the approaches, is 2¾ miles long and contains 50,000 tons of steel; the main span is 1,659 ft. long and 160 ft. wide, the arch containing 27,000 tons of steel. The concrete roadway has a bitumen surface; on one side is a double set of tram rails and on the other a double set of electric-train rails. Tolls are collected on the southern end of the bridge.

The shocks were reported in some cases as being of considerable intensity and accompanied by blue sparks from the car bodies. They were received when the hands of the toll collectors and motorists met, or when the collectors—whether on their wooden stands or on the roadway—touched the car bodies. One report indicated that shocks were most noticeable when the atmosphere was warm and when an engine was accelerating. The trouble was eliminated by the provision of rubber mats for the collectors to stand on and an earthed metal wiper in each roadway for the car-axles to brush against.

Tests indicated that there was no leakage of current in the roadway. Many engineers put forward the theory that a static charge was given to the car body through its moving through dry air. The explanation which appears to me to come nearest the mark takes account of the following facts that have been insufficiently stressed by most writers: (1) The shocks were experienced during the first few days after the bridge had been opened when considerable traffic passed; and (2) the weather during these days was hot and very dry.

It is suggested that a pall of dust of more or less uniform intensity existed above the roadway due to the stream of traffic which "rubbed" the polished surface of the cars, thus producing a static charge. The charge could reach quite a high value, as it could not escape through the rubber-covered wheels; moreover, the polished duco is an insulator and would hold the charge on the outer surface of the cars.

Since the installation of the earthing apparatus no shocks have been felt, but this does not necessarily prove its efficiency. If the theory suggested is the right one, no shocks would be felt under normal traffic conditions, when there would be no dust pall above the roadway, or when the atmosphere was cold or humid.

I should be glad to hear from your readers whether similar happenings have been noticed on bridges in Great Britain or elsewhere, and if so what explanations they would offer and what remedies they would propose.

Sydney, N.S.W., *April 15th*, 1932. N.S.

A Fulham Contract

On page 789 of your issue of May 27th it is stated that the tender of this company for certain switchgear has been recommended for acceptance by the Fulham Corporation Electricity Department. We wish to point out that this gear is for installation in the existing Fulham power station, and not in the proposed new station, as the wording of the notice would seem to imply.

FERGUSON, PAILIN, LTD.
J. Reed Wilkinson, *London Manager*.

London, W.C.2, *May 30th*, 1932.

Shoddy Motor Wiring

Mr. F. Harrison has no justification for his assumption that the whole of the small motor industry is engaged in turning out junk, and has no need to "hang his head in shame." The root of the trouble is surely that the potato washer maker in question, unwilling to pay a few extra shillings to obtain a first-rate motor, fitted a cheap, unsatisfactory, foreign motor. The fault lies not with the electrical industry, but with the machinery manufacturer, who should have known that a first-class article cannot be bought at a third-class price.

There are far too many manufacturers of machinery at the present time who buy their motors solely on price without any consideration of the quality of goods they are obtaining. Such manufacturers do not stop to think that a badly designed and badly constructed motor can damn their products just as effectively as bad workmanship on their own part, and by buying on price alone they are endeavouring to drive the British small motor industry into turning out inferior machines, such as they have, until lately, been in the habit of buying from abroad.

I am glad to say that the British motor industry has refused to be driven into these courses, and that there are plenty of first-rate British motors on the market in which the quality of workmanship and materials leaves nothing to be desired. If Mr. Harrison will call on me next time he is in London I will show him that he has no need to be ashamed, and that better small motors are made in England than anywhere else in the world.

R. A. MALLET,
Director, Normand Electrical Co., Ltd.

London, S.W.4, *May 30th*, 1932.

Automatic Combustion Control

We have read your leader in the issue of May 13th, and your short description of this plant in the issue of May 27th with some interest, but we rather think the way you have described the plant will lead some of your readers to draw erroneous conclusions.

You make rather a point that the automatic system at Hackney comes into operation when a fog descends. There is surely nothing novel about this; it has been done for years. It is the primary function of automatic control. We have had Hagan automatic control for boilers in operation for some years in a good many power stations where not only does the control come into operation if a fog comes on, but it also operates in the reverse direction when the sun shines again!

We think you are hardly right in describing this as the first instance of a control room where the state of affairs in the boiler house can be seen at a glance. This has been done before, in France anyway, and probably in America.

The principal advantage of automatic control as against remote control is to obtain substantial economies, and your leader would rather lead one to suppose that Mr. Robinson does not think he is going to obtain very much economy, but we sincerely trust that, for the progress of automatic control in general, this will not prove to be the case.

JAMES GORDON & CO., LTD.
James Gordon, *Director*.

London, W.C.2, *May 30th*, 1932.

"Do It Electrically!"

I have followed carefully your propaganda for the extended use of electricity, and have brought it to the notice of the Council and the local Burgesses' Association in this not electrically minded borough. On the van belonging to the Hornsey Electricity Department there appears the slogan in large letters: "Do It Electrically!" I, just one of the residents, wish the Electricity Department practised what it preaches.

At a meeting of the Hornsey Burgesses' Association it was stated that if streets were lighted by electricity the mains would be available for ratepayers to tap, but Mr. Alderman Moritz at the last Council meeting declared this to be impossible. I know of at least one borough where it is done, and that borough has nearly 14,000 slot meters on its rental wiring scheme mostly tapped to the street lighting mains.

May 27th, 1932. HORNSEY, N.8.

Parliamentary

[From our Special Reporter]

REPLYING to a question by Mr. H. Williams regarding the amount of depreciation which had been written off the capital expenditure of £294,000 on the assets of the Leatherhead and District undertaking transferred to the London and Home Counties Joint Electricity Authority, Mr. Pybus, the Minister of Transport, stated on May 25th that the amount credited to the depreciation and reserve account at December 31st, 1930, was £63,852. He added that it was not the general practice of electricity supply companies to write down their capital expenditure until such time as particular assets disappeared.

Standardisation of Frequency

On May 26th, in reply to a number of questions by Sir Douglas Newton with regard to the national standardisation of frequency of electricity supply, Mr. Pybus said that the estimated cost of effecting the standardisation of frequency throughout the country was £19,000,000 gross and £16,300,000 net. The amount actually paid by the Central Electricity Board to authorised undertakers in respect of standardisation amounted on April 30th last to about £5,275,000. Standardisation of frequency was now being carried out in Central Scotland, Central England, North-west England and North Wales, North-east England, South-west England and South Wales, and in one generating station in South-east England; and there were a few isolated undertakings which it might be expedient to convert to standard frequency. The cost still to be met was estimated at about £13,725,000 gross.

A Scottish Scheme

On May 26th Lord Scone asked the Minister of Transport if he would state the result of the inquiry held recently into the causes of the delay of the installation of electricity by the Grampian Electricity Supply Co. in the village of Errol, Perthshire.

Captain Hudson, who replied, said that the Minister had received the report of the inquiry, and he hoped shortly to be in a position to announce his decision.

Legal

IN a King's Bench Divisional Court on May 26th the Lord Chief Justice and Justices Avory and Macnaghten delivered their reserved judgment on the appeal by the St. James' & Pall Mall Electric Light Co. from a decision of the Assessment Committee of the City of Westminster that the valuation of the company's premises for rating purposes was not to be reduced below £89,922 gross and £44,961 net value.

The company claimed that it was entitled to have taken into account annual payments to certain sinking funds set up by Statute in order that the undertaking may be transferred without charge in 1971 to the Joint Electricity Authority set up under the London and Home Counties Electricity District Order, 1925.

The matter came before the Court on a special case stated under Section 40 of the Valuation (Metropolis) Act, 1869, by order of Mr. Justice Charles.

The Assessment Committee had reduced the valuation of the company's premises from £110,000 gross and £55,000 net value, to £89,922 gross and £44,961 net value.

The company contended that it should be reduced to £72,664 gross and £36,332 net value. In considering the question of principle, the company said that it involved what a hypothetical tenant would give, and a profit basis should be taken. On that basis the company said the hypothetical tenant would take into account what the company had to set aside each year out of revenue for the purpose of the two sinking funds established by Statute to liquidate the value of the company's assets, and these must be treated as costs and charges of the undertaking.

Mr. Justice Avory, delivering judgment, said that the question for determination was whether the portion of the appellants' revenue which was collected to finance the sinking funds should be taken into account in arriving at the gross and rateable value of the hereditaments in question. In other words, whether the hypothetical tenant from year to year, who could derive no benefit from the sinking funds provided, should take into account in calculating the profit to be derived by him, that portion of the receipts which had to be collected to meet the contributions to the sinking funds and the interest thereon.

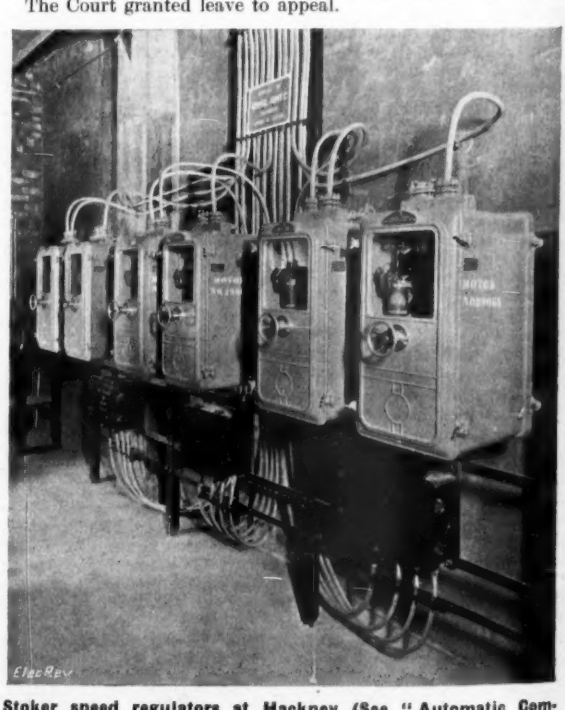
In His Lordship's opinion that portion of the receipts would not be taken into account in calculating the profits to be derived by him, especially in view of the restrictions imposed upon him by the fixing of the standard charge or price charged for electricity, and it could not be assumed that a tenant would pay a larger rent for the benefit of collecting money for the benefit of the landlord.

It followed, therefore, that so much of the receipts as was collected to provide the sinking funds and interest would form no part of the profit accruing to the tenant, and should be excluded in ascertaining the rent the hypothetical tenant would pay. It was an exceptional case governed by special legislation and for this reason he found that the appellants' contention was correct and that the gross and rateable values should be reduced to £72,664 gross and £36,332 rateable value.

The Lord Chief Justice and Mr. Justice Macnaghten concurred.

Mr. T. Jones, K.C., for the respondents, said that this was in the nature of a test case, and he asked for leave to appeal.

The Court granted leave to appeal.



Stoker speed regulators at Hackney (See "Automatic Combustion Control," p. 807)

New Apparatus and Devices

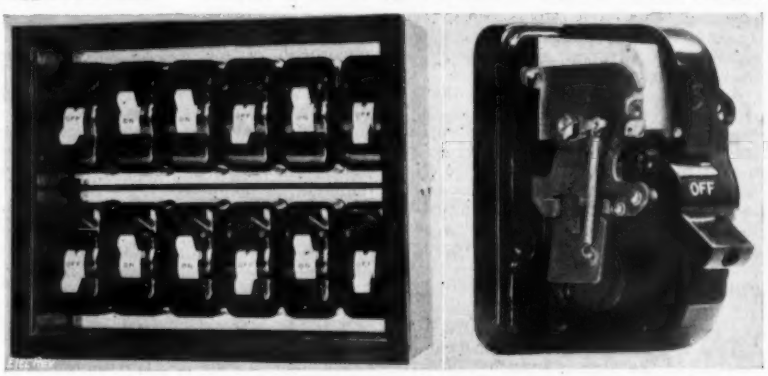
for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Small Circuit Breakers

The initial cost has for a long time prevented the extensive use of small circuit breakers in places where fuses are possible, but with the increase in the use of electrical apparatus something more reliable and easier to reset is demanded. When inexperienced people replace the fuses, and this is often the case in private houses, fuse wire of any thickness is often used, whereas a circuit-breaker may almost be termed fool-proof.

MESSRS. NALDER BROS. & THOMPSON, LTD., 97A, Dalston Lane, London, E.8, have started marketing a range of small "Bijou" circuit-breakers, which are only 4 in. long and 1⅛ in. wide, enabling any number to be built up together as a distribution board. They are designed to open circuit when a predetermined current passes, the standard models operating with a current 50 or 100 per cent. above normal: those fitted with a bi-metal time lag are calibrated to open circuit when the normal current is exceeded by 50 per cent. for thirty seconds.

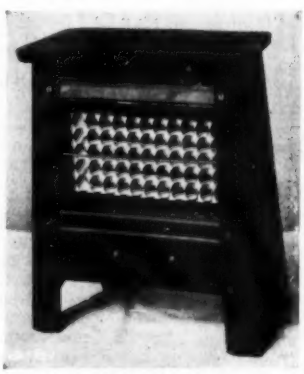
An oversetting device can be provided for motor starting. The breaker is made in seven models designed to carry 1, 3, 5, 10, 15, 20, and 25 A respectively.



A "Bijou" distribution board and a side view of a circuit breaker

Small Fires

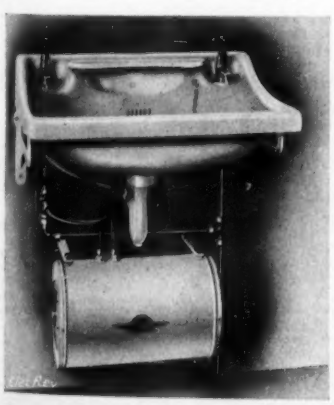
MESSRS. GIRLINGS, LTD., Electricity Works, Maldon, Essex, are now marketing a range of remarkably cheap electric fires. The "Mosaic JSA½" is a ½-kW fire with a c.i. grid top and coppered reflector, and the spiral element is supported every half-inch in a flexible porcelain base. The type "JSB½" is similar in construction except that the top is embodied in the sheet metal frame while the inserts are of polished aluminium instead of copper. These two models are also made with ½-kW loadings.



A "Mosaic" fire

A Novel Water Heater

The average domestic consumer thinks in terms of cookers, vacuum cleaners, irons, fires, and of course lighting, but the idea of electric water heating has not yet got very far with him. Bulkiness prejudices the mind of the small householder against all water-heaters, but the new "Heatrae," which we illustrate, can be conveniently fitted under the wash basin.



The new "Heatrae" water heater

It is a displacement type heater operated by what appears to be a standard hot water tap fitted to the basin. The control of water, however, is on the cold water inlet to the water heater and this is accomplished by removing the interior of the hot water tap and putting in its place a long stem which passes down through an annular chamber and operates a standard cold water valve. The hot water is discharged from the heater through a pipe which is connected to this annular space around the operating spindle, there being direct connection from this space to the tap.

The hot water outlet being always open allows freedom for expansion of the water during heating and avoids any possibility of pressure arising in the water heater. The fittings provided on the water heater are suitable for copper pipe connections and these connections are supplied complete with the heater if desired. The heater is horizontal, inspection being from one end, and it is made reversible. Provision is also made in the design for the hot water tap to be either on the left or right hand side, there being four possible combinations.

All working parts can be inspected with the greatest ease and the heater complete can be removed in a few minutes simply by undoing two copper pipe unions and removing the bracket bolts. There is an arrangement to prevent water being drained or siphoned out from the heater by the opening of a tap on the cold water supply pipe at a lower level simultaneously with the water supply failing. The manufacturers, ELECTRIC FIRES, LTD., Norwich, provide the heater in 1½ and 3-gallon sizes with a loading of from 500 to 1,000 W.

A New Electric Clock

MESSRS. FERRANTI, LTD., Hollinwood, Lancs, have just brought out a clock suitable for fitting in the front panel of wireless receivers. It is suitable for use on a.c. mains with a controlled frequency of 50 cycles.

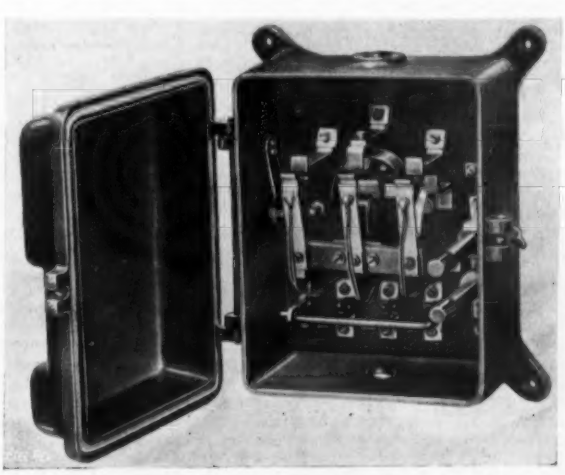
The Ferranti "radio" electric clock

An Automatic Starting Switch

One of the latest products of THE SOLENOID REGULATOR CO., 268, Moseley Road, Birmingham, is a new 15-A automatic starting switch for small motors. It can be used for starting squirrel-cage induction motors on any a.c. supply up to 500 V by switching direct on to the line.

It is of the contactor type, the contactor operating as a no-voltage release. A thermal type of overload protection is included, and is adjustable to 125, 150 or 200 p.c. full load current. It does not operate on short overloads, and has a quick-break action, the resetting being operated by a push button outside the case.

The contacts and operating coil are renewable from the front without removing the switch from its case, and there are 1-in. clearance holes with removable wood bushes for incoming and outgoing cables, while starting and stopping is effected by two push buttons built into the front of the switch. It is also suitable for remote control, and weighs 21 lb. Models are obtainable with one or two overload releases, and also with a separate stop and start push-button.



The "Solenoid" starting switch

New Books

Alternating Current Bridge Methods. By B. HAGUE. Pp. xiv +424; figs. 122. London: Sir Isaac Pitman and Sons. Price 15s.

The call for a third edition of a work on so specialised a subject as a.c. bridge tests so soon after its last revision in 1929 is a high compliment to the author, and we congratulate Dr. Hague on the wide measure of acceptance which his authoritative and exhaustive treatise has achieved. In the present edition the text of the previous edition is retained practically unaltered, only minor corrections having been made. There is, however, added a copious appendix giving an excellent summary of advances in the theory and technique of a.c. bridge testing during recent years.

Among the most important of the sections of this appendix we notice very complete articles on the theory of the Campbell condenser bridge, the theory of impurity in mutual inductances, and a summary of recent literature relating to the practical use of the Schering bridge. With this addition Dr. Hague's book will easily retain its position as the premier work on the important branch of a.c. testing with which it deals; for lucidity of theoretical explanation, and for completeness of practical detail it could hardly be improved upon.

Pitman's Electrical Educator. Edited by Sir Ambrose Fleming. Pp. 1,640; illustrated. London: Sir Isaac Pitman and Sons, Ltd. Price: £3 12s. for 3 vols.

This is a second edition of a most useful work of reference relating to the various branches of electrical science and commerce. The contributors include well-known authorities on specific subjects. The matter is attractively arranged in short chapters, with frequent illustrations and diagrams.

The Mathematics of Wireless. By RALPH STRANGER. Pp. xi+193; figs. 113. London: George Newnes, Ltd. Price 5s.

The object of this book is to provide an introduction to mathematics for the "man-in-the-street" who wishes to study the subject of wireless communication, with reference especially to the technique of broadcast reception. Each subject, so far as it goes, is dealt with in that clear and chatty style which the author has used in his other books on wireless, some of which have been reviewed in these columns.

The field covered is, however, far too wide to allow of anything more than a nibble, which is the expression used, at each of the various subjects considered from simple arithmetic to the calculus, and it is perhaps doubtful whether this nibbling process is really the best method to "ignite a spark of interest in your manly breast and launch you well on the road to further progress," as the author optimistically puts it.

Handbook for Wireless Telegraph Operators (revised in accordance with the Radiotelegraphic Convention, Washington, 1927). Pp. 137. Stationery Office. Price 9d. net.

This book is intended to be a manual for the guidance of operators on board ship and at coastal stations with regard to the handling of wireless messages. It does not in any way deal with the principles of radio-telegraphy, the details of apparatus, or systems.

* * *

Shorter Notices

"Sands, Clays and Minerals." Published by Algernon Lewin Curtis, P.O. Box 61, Westmoor Laboratory, Chatteris. Subscription 5s. per annum.—This new quarterly publication is described as "a magazine devoted to economic minerals," and aims at giving wider publicity to the development of minerals within the British Empire and their application to British industry. It has 40 pages and is well illustrated.

"The *Electrician* Annual Tables of Electricity Undertakings," 1932, forty-fifth edition. Pp. vii+238. London: Ernest Benn. Price 10s.—This complete reference book has again been entirely revised, and an extra table has been included dealing with the Union of South Africa. A note is now made in the case of the home undertakings if the frequency is controlled.

"Chromium Plating," by E. S. Richards. Pp. 131, figs. 70. London: Charles Griffin & Co., Ltd. Price 7s. 6d.

"Meter Engineering," by J. L. Ferns. Pp. 270; figs. 168. London: Sir Isaac Pitman & Sons. Price 10s. 6d.

India's Electrical Imports

Figures for 1928-1929 and 1929-30 compared

FULL details of India's imports of electrical apparatus and machinery in 1929-30 have recently been published. Below are given the leading items with the principal countries of origin of the goods. The increase or decrease as compared with the previous twelve months is also shown, except in the case of lamps, the classification of which has been altered.

In the trade in apparatus, as distinct from machinery, the total value was greater than in any year since 1918-19, with the exception of 1920-21 and 1921-22. Great Britain supplied nearly two-thirds of the total and Germany showed signs of overtaking the United States as the next most important supplier, a position which it will probably be found she attained in 1931.

Electrical machinery imports as a whole showed only a small advance on 1928-29. Those from the United Kingdom declined slightly, as also did those from the United States. Imports from Germany made a small advance but remained at less than one per cent. of the total.

	1929–30 Thous. Rupees.		Inc. or Dec. Thous. Rupees.
Fans—			
Total	3,980	+	140
From U.K.	1,890	−	480
„ Germany	475	+	160
„ France	11	+	4
„ U.S.A.	370	+	265
Wires and cables, rubber insulated—			
Total	4,230	+	230
From U.K.	3,470	−	90
„ Germany	330	+	120
„ U.S.A.	90	+	40
Wires and cables, insulations other than rubber—			
Total	4,320	+	1,280
From U.K.	4,040	+	1,480
„ Germany	90	−	20
„ U.S.A.	105	−	105
Telegraph and telephone wires and cables—			
Total	85	−	90
From U.K.	70	−	100
„ Germany	14	+	13
Telegraph and telephone instruments and apparatus—			
Total	545	+	20
From U.K.	485	+	20
„ U.S.A.	27	−	2
Lamps—flashlights—			
Total	1,150		—
From U.K.	20		—
„ Germany	240		—
„ U.S.A.	830		—
Automobile lighting lamps—			
Total	140		—
From U.K.	10		—
„ Holland	60		—
„ Japan	50		—
Standard lighting lamps—			
Total	2,600		—
From U.K.	855		—
„ Germany	100		—
„ Holland	910		—
„ Italy	106		—
„ Austria	102		—
„ Czechoslovakia	118		—
„ Japan	156		—
Other electric lamps—			
Total	100		—
From U.K.	50		—
„ Germany	40		—
„ Holland	20		—
„ U.S.A.	15		—
Lamp parts and accessories—			
Total	2,455	+	1,765
Batteries—			
Total	1,370	+	60
From U.K.	180	−	10
„ Germany	360	+	100
„ U.S.A.	770	+	20
Carbons—			
Total	290	+	155
(Mainly from U.K.).			
Accumulators—			
Total	2,590	+	600
From U.K.	1,830	+	250
„ Belgium	320	+	280
„ U.S.A.	340		—
Condensers—			
Total	2	−	18
(Mainly from U.K.).			
Bell apparatus—			
Total	15	−	2
From Germany	6		—
„ U.K.	4	+	1
Lighting accessories—			
Total	1,660	−	30
From U.K.	1,030	−	240
„ Germany	320	+	40
„ U.S.A.	160	+	90
Electric meters—			
Total	930	+	200
From U.K.	690	+	100
„ Germany	120	+	35
Other electrical instruments (not telegraph or telephone—			
Total	250	−	165
From U.K.	120	−	190
„ Germany	100	+	40
Electro-medical instruments—			
Total	430	+	60
From U.K.	105	−	15
„ Germany	70	−	20
„ U.S.A.	210	+	60
Switchboards (not telegraph or Telephone)—			
Total	290	−	100
From U.K.	250	−	170
„ Germany	20	−	10
Electrical goods and apparatus (unenumerated)—			
Total	5,700	+	750
From U.K.	3,820	+	930
„ Germany	735	+	65
„ Japan	85	−	65
„ U.S.A.	870	−	240
Electric control and switchgear—			
Total	3,830	−	700
From U.K.	3,250	+	650
„ Germany	260	+	120
„ U.S.A.	260	+	10
Generators, alternators and dynamos—			
Total	4,400	+	100
From U.K.	3,880	+	130
„ Germany	235	−	65
„ Switzerland	110	+	107
„ United States	50	−	65
Motors—			
Total	4,380	−	120
From U.K.	3,510	−	600
„ Sweden	40	−	30
„ Germany	250	−	40
„ Belgium	120	+	95
„ Italy	55	+	35
„ U.S.A.	355	−	455
Transformers			
Total	1,860	+	770
From U.K.	1,190	+	460
„ Sweden	100	+	70
„ Germany	120	+	70
„ U.S.A.	370	+	130
Turbo-generating sets—			
Total	800	+	200
From U.K.	540	+	370
„ Switzerland	105	+	15
„ Italy	110	+	110
„ U.S.A.	40	−	70
Other electrical machinery—			
Total	8,790	−	1,380
From U.K.	5,950	−	2,220
„ Canada	190	+	190
„ Germany	750	+	240
„ Belgium	280	+	140
„ Switzerland	35	+	15
„ Italy	230	+	200
„ Japan	140	+	50
„ U.S.A.	900	−	190

A New Battery

APART from minor details, the design and construction of dry battery cells have changed very little for years. By the careful selection of materials and the use of special hygroscopic chemicals it is possible successfully to retard deterioration for an appreciable period of time, but, until now, no one has produced a dry cell in which the active materials are perfectly sealed against evaporation of the essential moisture upon which the maintenance of efficiency is very largely dependent.

The new cell evolved by Messrs. Siemens Bros. & Co., Ltd., embodies a patented device which seals in the active ingredients whilst at the same time permitting the free exit of gases evolved when the cell is producing current. In addition, the cell is manufactured on the well-known "Full O' Power" principle, which consists of a thin paper lining to the zinc container into which the depolarising mixture is heavily compressed. This method of construction dispenses with the usual fabric wrapped "dolly" and enables a greater proportion of active depolarising material to be compressed into the cell.

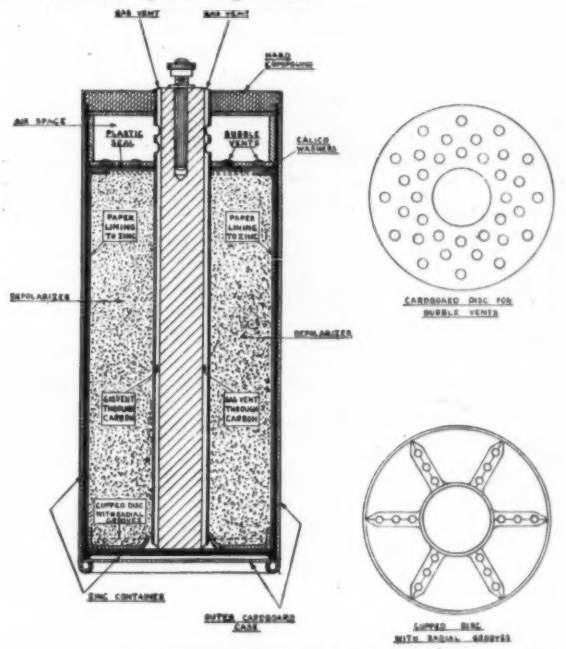
Our illustration shows that the central carbon rod has two narrow holes longitudinally throughout its length and spaced diametrically opposite. At the bottom of the cell a cupped disc of cardboard with radial grooves fits closely round the bottom of the carbon rod and against the paper lining. The depolarising mixture is then tamped into the space between the paper lining and the carbon rod up to within approximately 1 in. of the top of the zinc container and just below the top edge of the paper lining, which is then turned down over the moistened mixture. The sealing-in of this mixture is then effected by running in a layer of plastic compound, which can be said to hermetically seal the contents of the cell. On top of this seal is placed a circular disc of impregnated cardboard in which a number of small holes are punched, and this is pressed firmly down on to the compound.

Release of Gases

The manner in which this novel device permits of the escape of gases is as follows: When the gas pressure generated inside the depolariser increases sufficiently the compound is forced up through the holes in the cardboard disc in the form of bubbles, and when their tension becomes great enough these bubbles burst, allowing the gas to escape into the air space above. The immediate collapse of the bubbles effectively re-seals the cell. The air space at the top of the cell connects with the vents through the carbon by means of slots cut into the carbon rod. The reason for the cupped disc with radial grooves in the bottom of the cell is that by this means any gas generated at the base of the cell shall have a means of exit through the vents in the carbon.

This cell is the result of a very considerable amount of research carried out over a long period, and its performance in actual service has proved to be very satisfactory. Curiously enough it does not show to advantage on the usual quick test through 10 ohms continuously, and the manufacturers particularly stress the fact that it is only in actual service that its superiority becomes manifest.

Some idea of its possibilities may be gathered from the fact that the weight of the cell is 2 lb. 6 oz., with dimensions of 2 in. diameter by 6 in. high overall.



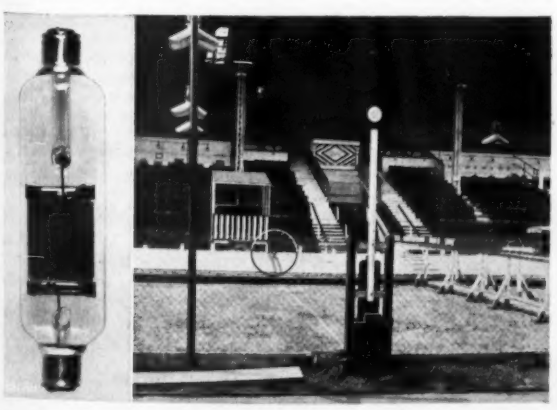
A sectional drawing of a No. 640 cell

Two types are supplied; one described as the No. 640 size for general purposes and a No. 6 size specially designed for long life on telephone maintenance and similar work. The latter cell has a thicker zinc and a more highly active depolarising mixture. An extraordinary fact about the No. 640 size cell is that it will give a short circuit current of approximately 50 A. On the other hand, the No. 6 size cell designed for exceptionally long service gives only 20 A on short circuit.

The Applications of Selenium Switches

LIGHT-SENSITIVE apparatus in a variety of interesting forms was demonstrated recently by Automatic Light Control, Ltd. All these switching devices incorporate a selenium bridge, which is actuated by light in one way or another.

The bridge itself is robust and housed in an evacuated glass tube. The A.L.C. type is said to withstand considerable voltage, so that battery operation is not always essential. It is not susceptible to damage by over voltage or strong light,



Left: A large industrial type selenium bridge. Right: A greyhound track equipped with A.L.C. timing apparatus. The cell and amplifier box is seen in the foreground with the lamp (ringed) producing the beam opposite

and when operated in conjunction with a single simple valve amplifier ample output is obtainable to actuate a substantial relay without refinements.

The commercial and industrial applications of selenium bridges are growing daily. In the last 18 months this company has supplied 2,250 cells to one "talkie" film concern alone. They are being used on greyhound racing tracks to time dogs to 1/100th second, and for the control of street lighting; apparatus designed by the company is in successful use in New Zealand, and tests recently made in England have proved satisfactory. A smoke indicating and recording unit has been in constant commercial use for a year.

Application to Factory Lighting

Apparatus has been devised whereby the lighting of a factory may be controlled by a single unit, and yet each individual floor or section can be separately switched. Any floor or section may be artificially illuminated when the daylight falls below a certain standard, quite regardless of the prevailing light conditions in other portions of the building. Large savings can be effected by the use of the instrument in the energy used for lighting.

Colour testing and turbidity indicators may be used in industries where the accurate matching of colours or tints is required. The system can also be used in the bottling of liquids when regular clarity is important.

Apart from automatic display and shop window lighting, "Auto-Ray" apparatus can be made to control outside illuminated signs and the floodlighting of buildings. In this application the light rays of motor car head lamps are utilised as follows: a motor car approaching the sign automatically causes it to light up and remain alight until the car has passed when the sign is automatically extinguished. There is a considerable saving in energy consumption as no current is being used when there is no traffic. The control of the whole of the lighting of petrol filling stations can be arranged, and also means provided for giving warning of the approach of vehicles at cross-roads.

There is a large field in the commercial world for apparatus used for the counting of finished or partly finished manufactures, and for the checking of the loading and unloading of goods from ships, etc. Covered by three patents held by the company, this cell certainly has a very wide field of application. Natural selenium has an exceptionally high electrical resistance, and when suitably treated its resistance is considerably reduced and the element rendered highly sensitive to light. The preparation of the element and the subsequent annealing processes have an important bearing on the characteristics of the finished product.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

British Enterprise in China

In the Financial Section of this issue we record the registration of Dorman Long & Associates (China), Ltd., which has been formed to adopt an agreement with Dorman Long and Co., Ltd., Beyer, Peacock & Co., Ltd., the Metropolitan-Vickers Electrical Co., Ltd., Callender's Cable & Construction Co., Ltd., Babcock & Wilcox, Ltd., the Tilbury Contracting and Dredging Co. Ltd., John I. Thornycroft & Co., Ltd., and Edgar Allen & Co., Ltd., "to acquire any real or personal property, patents, licences, rights or privileges, to erect, construct, maintain and alter any buildings, works, ships, stores, plant and machinery." According to *The Times* it is proposed to place the resources in technical information and advice of the members of the group at the disposal of authorities in China with a view to bringing projects for public works such as railways, electric power schemes, harbours, &c., to fruition. It is believed that the ability to assume complete responsibility for large schemes by one group and to bring nebulous but attractive schemes into concrete form will enable projects to be financed which otherwise might remain unattempted. The managing director is Mr. F. Freeman, who visited China last year on behalf of Messrs. Dorman Long and Co., Ltd.

Radio Factory Extensions

Extensions with an area of 12,000 sq. ft. are being made to the Liverpool factory of Messrs. Wingrove & Rogers, manufacturers of electrical and radio goods. The factory is being increased by approximately one-third its present size, and will provide employment for about 500 more workpeople.

New Showrooms at Bingley

The new electricity showrooms of the Urban District Council, which were the subject of a long controversy some time ago, have now been completed, and were opened for business, without ceremony, on May 30th. The new building is of three storeys, with the ground floor as showroom and general public office. Consumers have to pass through the showroom to reach the office, thereby having ample opportunity to see what is on display. The first floor is a demonstration room, and includes also the manager's office. The two rooms on the top floor are for meter storage and testing.

Shoe Shop Lighting

Our illustration shows the premises of the True-Form Boot Co., Woodgrange Road, Forest Gate, which is representative of the many branches of this company in which a modern scheme of "Holophane" lighting has been introduced. The whole of the shop fronts have been rebuilt during the last two years, and for the show windows a specially designed "Holophane" prismatic reflector has been evolved, which is standardised throughout the branches. This reflector,

A typical example of "Holophane" shop-window lighting

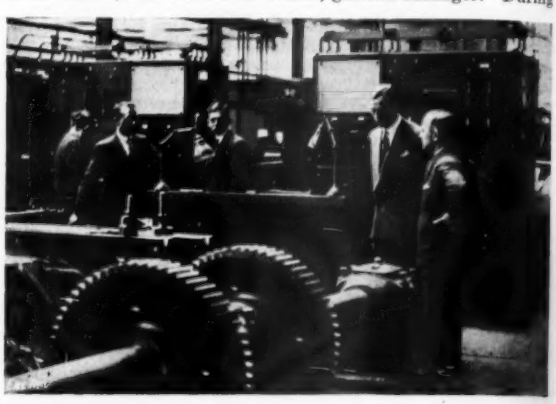
which gives a concentrating light distribution suitable for the method of window dressing, is fitted with a novel form of adjustable batten canopy, so that the lamps may be focused to give the best results. These shop fronts are arranged with translucent fascia, and stall board signs. In the fascia are the words "True Form" in transparent enamel letters, fitting flush into the marble, the latter being cut right through to the shape of the letters. In the back, above the window ceiling, is left a space 18 in. high to accommodate reflectors illuminating the sign, access being obtained from inside the shop. On a smaller scale, a similar arrangement is made for the stall board signs. The shop interiors are fitted with reflector units in the form of pendants, the appearance of both windows and interiors being extremely attractive.

The Advertising Convention

The Advertising Convention will be held this year at Liverpool from June 11th to 15th.

Prince George at Chelmsford

On the occasion of his visit to the Marconi Works at Chelmsford last week, Prince George saw encouraging evidence of expanding exports of British manufactures. At the entrance to the works His Higness was received by the Marchese Marconi, president of the company, Lord Inverforth, chairman of the board, and Mr. H. A. White, general manager. During



Prince George inspecting Messrs. Crompton Parkinson's factory

his inspection of the factory the Prince was shown various types of wireless stations which are being manufactured for export to several countries of the Far East, South America, and European countries. On the same day he also visited the works of the Hoffmann Manufacturing Co., Ltd., and Messrs. Crompton Parkinson, Ltd., and in the accompanying illustration is seen in the traction test room of the latter company.

Portable Electric Lamp Casings

The Standing Committee (General Merchandise) of the Board of Trade has reported on its inquiry into the question of marking imported casings for dry or secondary battery portable electric lamps, &c., and copies of the report will shortly be obtainable from the Stationery Office.

The African Market

With the publication of the sixth and final volume (price 7s. 6d.) on West, East and Central Africa, Messrs. Erlangers, Ltd., 4, Moorgate, E.C.2, complete their series of monographs on manufacturing industries of the British Empire overseas, the only countries not now covered being the Irish Free State, India, and a few outlying colonies in the Pacific. The object of these monographs is to give access in a concise form to a mass of statistical information relating to industrial and trading matters which has not hitherto been available in a single publication. A series of diagrams shows the various tariffs in operation in the British countries in Africa, and the imports and exports together with their origin and destination. A brief history is also given of each of the colonies with details of area, population, chief towns, railways, &c. In the preface to this latest volume the causes of the world crisis are reviewed, and the importance of the forthcoming Imperial Conference at Ottawa is stressed. It is held that the prosperity of the world is bound up with the recovery of Britain, and that this crisis cannot end until Britain is once more established as the financial arbitrator. The difficulties facing the Conference are discussed, and it is considered that if viewed imperially they will be overcome.

"A Bond of Union"

At a dinner of the Society of British Gas Industries held recently at the Hotel Metropole, Sir David Milne-Watson, in responding to the toast of "The Gas Industry," said that those engaged in it were still struggling for freedom. Freedom had been given to their rival, electricity, which in this country was practically derived from coal, and in that respect there was a strong bond of union between electricity and gas.

Conditions in the West Indies

Mr. J. L. Wilson Goode, Trade Commissioner at Port of Spain, Trinidad, has reported to the Department of Overseas Trade on economic conditions in the British West Indies (Stationery Office, 3s. net.).

In the course of his report Mr. Goode refers to the strong position of the United Kingdom in the islands' import trade, and dealing particularly with electrical goods he says that there are possibilities of increasing the United Kingdom trade in electrical goods, but it is essential that a wide range of articles be stocked locally so as to avoid long delays in obtaining supplies. One reason for the strong hold which America has secured on this market is that at the time the local electricity companies commenced operations American material was

cheaper than any other, and since the adoption of American standards the course of trade has continued with that country. In the British West Indies all the sockets and outlets are of the screw type. There is a small but growing demand in the British West Indies and contiguous British colonies for electric heating and cooking appliances, but so far the chief source of supply has been America. Now, however, that the local electrical companies are becoming increasingly interested in supplying their customers with appliances as well as with power, there is more opportunity than formerly of marketing British electrical productions. All the household refrigerators (small automatic type) appear to be of American manufacture. One United Kingdom firm has supplied refrigerating plants for which a demand has arisen concurrently with the development of the West Indian fruit trade with Canada, but apparently no real attempt has been made to secure a share of the trade in small refrigerators other than those for shop or factory use.

Conditions in Czecho-Slovakia

A Department of Overseas Trade report on the economic situation in Czecho-Slovakia at April 15th, 1932, says that although the country's favourable balance at the end of 1931 amounted to kr. 1,351 million, the monthly returns recorded a decline from November to March when a favourable balance of kr. 77 million was achieved. Trade has been severely handicapped by the British Abnormal Importations Act and practically no branch of industry has escaped the effects of the world-wide economic depression.

A view of the Cinematograph Trade Exhibition

Danish Import Trade

A confidential report containing an analysis of Danish import trade prepared by the Commercial Secretary to H.M. Legation at Copenhagen, has been received and circulated by the Department of Overseas Trade. United Kingdom firms wishing to obtain a copy should apply to the Department, 35, Old Queen Street, S.W.1, quoting reference C.X. 3882.

British Malayan Electrical Imports

The value of imports of electrical goods and apparatus into Malaya during 1931 amounted to $4,229,398, as compared with $5,059,030 in 1930.

An Ediswan Lighting Installation

The new building at Leicester of the Leicester Permanent Building Society is an excellent example of up-to-date lighting practice applied to a well designed office building. " X-ray " Floodray-type reflectors are employed for the special glass illumination while cornice troughs are utilised to light the dome over the main banking hall, which itself is lighted by Harcourt pendants of special design in conjunction with Harcourt desk standards. An idea of the excellent result obtained can be obtained from the accompanying illustration. The scheme was designed by the Edison Swan Electric Co., Ltd., in collaboration with the architects, Messrs. Lawton Brown & Percy C. Jones. " Royal Ediswan " lamps were used throughout.

Austrian Electrical Trade

The Department of Overseas Trade has published a report prepared by Mr. O. S. Phillpotts, late Commercial Secretary to H.M. Legation, Vienna, on the financial and economic position of Austria at the end of March, 1932. This shows that the economic situation during the last ten months was dominated by the collapse of its most important bank, the Credit-Anstalt. There was a notable shrinkage in Austrian foreign trade in 1931, the total value of imports being 19 per cent. less than in 1930 (United Kingdom share 15 per cent.), while the falling off in exports from Austria have been still greater both in value and in bulk than the imports. An appendix at the end of the report shows that imports into Austria of electrical machines from the United Kingdom in 1931 had a total weight of 27.9 tons, as compared with 35.8 tons in 1930, and of wireless apparatus 2.3 tons (against 1.3 tons). The exports from Austria to the United Kingdom in 1931 of electrical apparatus, &c., had a total weight of 170.3 tons (against 230.9 tons in 1930).

The Italian Electrical Market

Imports of electrical machinery and apparatus into Italy during January and February last amounted to £363,850, as compared with £598,390 during the corresponding period of last year. On the other hand, exports of similar material during the same period increased from £189,820 to £250,535. The Italian lire has been converted at 73 to the £.

The Cinematograph Trade Exhibition

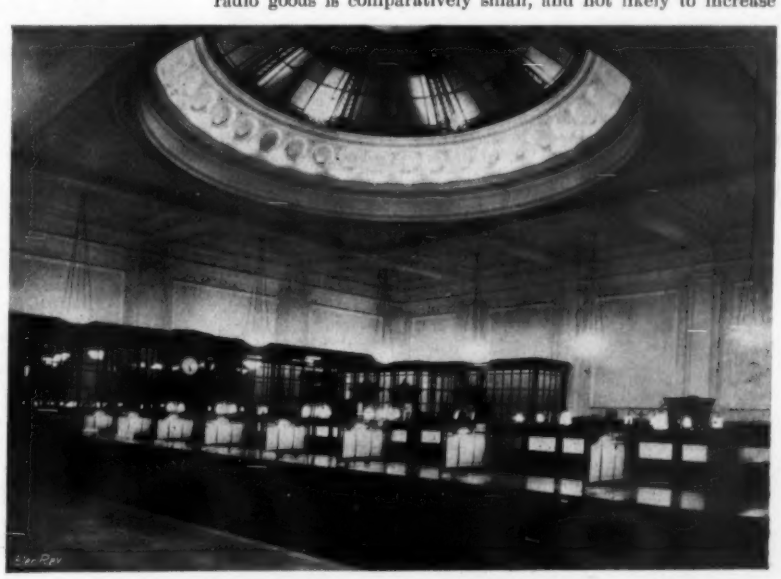
There are many exhibits by electrical firms at the Cinematograph Trade Exhibition, which was opened at the ice rink, Grosvenor House, Park Lane, W.1, on May 30th, by Mrs. Baldwin. The exhibition has been arranged in connection with the International Exhibitors' Congress and Annual Summer Conference of the Cinematograph Exhibitors' Association. Among the firms represented there are S. G. Brown, Ltd., who are exhibiting sound-film and radio apparatus; the Chloride Electrical Storage Co., Ltd., with specimens of " Exide " batteries and accumulators, as well as the " Keepalite " system, while the D.P. Battery Co., Ltd., Batteries, Ltd., and Oldham & Co., Ltd., also have exhibits. Gramo-Radio, Ltd., are showing examples of their large loudspeaker units. Among those exhibiting sound-film apparatus are the Western Electric Co., Ltd., R.C.A. Photophone, Ltd., and Electrocord, Ltd. K.F.M. Engineering Co., Ltd., Neolight Sign Co., Ltd., Stransigns, Ltd., and Venreco, Ltd., are all exhibiting lighting effects and signs, while Holophane, Ltd., has one of the most striking stands in the exhibition, where a decorated Wurlitzer organ is being continually lighted in changing and blending colours, producing a most striking effect.

The Strand Electric Co., Ltd., is showing a new spot light with a magnetic colour-changing device.

A mercury-arc rectifier is exhibited by the Hewittic Electric Co., Ltd., while crude-oil engines are shown on the stands of the National Gas Engine Co., Ltd., Ruston & Hornsby, Ltd., and Petters, Ltd. The Sturtevant Engineering Co., Ltd., and J. G. Statter & Co. also have stands. The exhibition closes this (Friday) evening.

The Spanish Radio Market

A report of the Department of Overseas Trade on the market for radio apparatus in Spain states that, in spite of the general trade depression and the poor quality of the local broadcasting programmes, interest in radio reception is growing among all classes of the public, and the demand for receivers and components is now considerable. The United Kingdom's share of the trade is, however, steadily decreasing in volume, though British loudspeakers are still in favour. Local production of radio goods is comparatively small, and not likely to increase



Ediswan lighting in a Leicester building

very much in the future. Any considerable expansion of the market in the future is dependent to a large extent upon a return to more settled economic and financial conditions, and it is considered that there are reasonable possibilities of the United Kingdom recapturing a portion of the market lost and participating to some extent in the increased trade predicted when the present economic depression has passed.

The N.S.W. Electrical and Radio Exhibition

The Development Publicity Section of the Electrical Association of New South Wales, known as the Electrical and Radio Development Association, held its seventh annual exhibition at the Sydney Town Hall, N.S.W., from March 2nd to 12th. It was one of the largest trade exhibitions ever held in Australia, and a most comprehensive range of the latest electrical and radio equipment was displayed. A special feature of the exhibition was the decorative lighting arrangements and illuminations in both the main hall and vestibule. In all about 30,000 people paid for admission.

New Simplex Conduits Branch

A new Midland Sales and Service Depôt has recently been opened by Simplex Conduits, Ltd., at 4-5, Freeman Street, Birmingham (telephone: Midland 2135). These premises are very spacious and will permit heavy stocks of all standard

A new Simplex Conduits depôt

Simplex and S.E.S. goods to be carried. The new branch will be the headquarters of the company's three Midland representatives, Messrs. W. F. Underwood, G. H. Westwood, and H. M. Taylor, while the depôt delivery and counter sales services will be in charge of Mr. C. S. Boulton. An exterior view of the new premises is shown in the accompanying illustration.

Kandem Electrical, Ltd.

Messrs. Korting & Mathiesen Electrical, Ltd., inform us that the name of the company has been changed to Kandem Electrical, Ltd., the name under which its products are known having been adopted.

Recent Contracts

Standard Telephones & Cables, Ltd., has received the order from the G.P.O. for an automatic exchange of the step-by-step director type for Hounslow in the London telephone area. The exchange will be equipped initially with 5,000 lines and will be capable of extension to 10,000 lines. It is anticipated that Hounslow subscribers will be connected to this exchange towards the end of next year.

The Cambridge Instrument Co., Ltd., has secured the order for the whole of the temperature measuring instruments for the new Dunston power station, Newcastle-on-Tyne. The same company has also instructions to supply through sub-contractors a number of 13-in. illuminated dial thermometers for the reheater steam pipes.

Siemens Electric Lamps & Supplies, Ltd., has received a further contract from Epsom Urban District Council for twelve months' supply of electric lamps.

Trade Announcements

Messrs. M'Cowan & Guild, electrical contractors, Perth, have opened new business premises at 194, High Street, Newburgh.

After to-morrow, June 4th, the Service Department of the Marconiphone Co., Ltd., will be transferred permanently from Dagenham to Hayes, and in future all service communications should be addressed to Sheraton Buildings, Hayes, Middlesex (telegraphic address, "Service, Hayes, Middlesex"; telephone, Southall 2468). This alteration does not affect the service from the London and provincial depôts.

The Henderson Electrical and Wireless Service will shortly be opening a branch at Vale Hall, Vale Road, Tunbridge Wells (telephone: Tunbridge Wells 2206). The branch will be under the management of Mr. P. H. Belder, and Mr. E. A. Boxall, who has been with the company a considerable time, will be attached to the branch as outside representative.

The Hydronyl Syndicate, Ltd., has removed to 50, Queen Anne's Gate, S.W.1.

Messrs. Ward & Goldstone, Ltd., state that they have now completed the removal to their new London depôt at 5, Percy Street, Tottenham Court Road, W.1. (Telephone: Museum 6467.)

E.A.W. Visit to Liverpool

On May 26th members of the Electrical Association for Women (Halifax Branch) paid a visit to the works of the Liverpool Electric Cable Co., Ltd., where they witnessed the manufacture of "Lecite" cables and flexible cords and the "Lecite" wiring system. The ladies were taken round in small groups and the various manufacturing processes were explained to them. In the afternoon the party visited the Liverpool Docks and inspected some of the largest liners.

For Sale

Mr. S. J. Baker is to sell by auction on June 8th at the works of Kelly's Directories, Ltd., various electrical and letterpress printing plant and machinery. (See our advertisement pages to-day.)

Prices of Materials

Messrs. F. Smith & Co. report, June 1st: No change in the prices of silicium bronze wire and electrolytic copper.

Messrs. Edward Till and Co. report, June 1st: India-rubber, Para fine, no change.

Messrs. James and Shakespeare report, June 1st: Copper bars (best selected), sheet and rod, £59, £2 dec.; English pig lead, £11 15s., 10s. dec.

New Catalogues and Lists

Belling & Co., Bridge Works, Southbury Road, Enfield, Middlesex.—A booklet entitled "Modern Electric Cookery," giving illustrations and full details of the company's range of all-enamel cookers with a number of specimen cooking recipes. Also a new cooking folder. Three new models of cookers have recently been introduced, and the prices of certain others have been reduced.

Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, E.C.4.—Publications H.C.764 and 768 on domestic and exhaust fans respectively.

Ashworth & Parker, Riverside Works, Bury.—A leaflet on the "Rotoklene" industrial type strainer.

L. McMichael, Ltd., 265, Strand, W.C.2.—Details of the new "Duplex Four" portable receiver (cabinet model).

Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, E.C.4.—A catalogue (No. 1070) illustrating and describing propeller fans and small ventilating sets. Also a folder (No. 4) dealing with vacuum cleaners.

Marelli & Co., Ltd., 19 & 20, Garlick Hill, Queen Victoria Street, E.C.4.—List GB/1932, giving particulars of the company's standard range of electric fans.

Medical Supply Association, Ltd., 167-185, Gray's Inn Road, W.C.1.—A 192-page illustrated catalogue entitled "Medical Electricity in General Medical Practice."

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.4.—Leaflet No. 250, dealing with a universal panel for the automatic control of electrically driven printing presses and machine tools.

Siemens Electric Lamps & Supplies, Ltd., 38-39, Upper Thames Street, E.C.4.—Leaflet No. 538, giving particulars of the new "Victor" electric iron.

British Aluminium Co., Ltd., Adelaide House, E.C.4.—A 54-page illustrated booklet entitled "Aluminium in Shopfitting."

Bull Motors, Ltd., Ipswich.—A leaflet giving details of a new range of a.c. "Super Silent" motors, fitted with sleeve bearings.

Mullard Wireless Service Co., Ltd., Charing Cross Road, W.C.2.—A number of sheets for insertion in the company's loose-leaf catalogue.

Power Plant Co., Ltd., West Drayton, Middlesex.—A booklet of graph paper.

Tangyes, Ltd., Cornwall Works, Birmingham.—A number of illustrated lists issued in connection with revised and new designs of horizontal and vertical oil engines, ram pumps, &c.

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Several new pamphlets for insertion in the company's sectional catalogue. Among the subjects covered are switchgear, short-circuit testing plant; air-break switches, fuses, and plugs; circuit breakers; electric oil-heating equipment; a.c. commutator motors; traffic control equipment; and domestic appliances.

British Home & Office Telephone Co., Ltd., 272/274, Vauxhall Bridge Road, S.W.1.—A leaflet dealing with intercommunicating telephone installations.

Marconiphone Co., Ltd., 210-212, Tottenham Court Road, W.1.—An announcement regarding a new range of h.t. and grid bias batteries placed on the market this week. Also a spare part list for radio-gramophone "Model 536."

British Domestic Appliances, Ltd., 3, Hanover Court, E.C.2.—A window poster, depicting the new all-British "Mary Ann" vacuum cleaner.

Petter's, Ltd., Yeovil.—The May "Petter's Monthly News," containing a description of the company's range of marine and industrial oil engines.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—Leaflet No. 341/42-1 dealing with balanced beam relays and line drop compensators.

Foster Instrument Co., Letchworth, Herts.—An 86-page book on thermo-electric pyrometers. Also a booklet containing graph paper.

Bankruptcy Proceedings

C. A. Brown, wireless and electrical engineer, 36, Leagrave Road, Luton, Bedfordshire.—The public examination was held recently at the Court House, Luton. A statement of affairs was submitted which disclosed ranking liabilities of £1,293, and net assets of £592, leaving a deficiency of £701. The debtor attributed his failure to over-stocking, entering into an agreement to purchase his premises, illness, and lack of capital. He said that his trade had fallen off since last Christmas, and he had been unable to liquidate his large stocks. The examination was adjourned.

J. W. White, radio and electrical engineer, 32, Castledene Road, Parkstone, Dorset. Trustee, Mr. F. H. Langmaid, Midland Bank Chambers, High Street, Southampton, released May 23rd.

W. Sutcliffe, electrical contractor, 40a, Old Church Street, Oldham.—Last day for receiving proofs for dividend June 11th. Trustee, Mr. R. K. Clark, Byrom Street, Manchester, Official Receiver.

W. Darbyshire, electrical factor and contractor, 65, Towngate, Leyland.—Last day for receiving proofs for dividend June 13th. Trustee, Mr. H. Parker, 9, Cannon Street, Preston, Official Receiver.

R. J. C. E. Lovelock (Dunblane Magneto Service), electrician, 280, Portswood Road, Portswood, Southampton.—Last day for receiving proofs for dividend June 13th. Trustee, Mr. F. H. Langmaid, Midland Bank Chambers, High Street, Southampton, Official Receiver.

A. J. Brookes, electrical contractor, 36, North End Road, Golders Green, Middlesex.—Receiving order made May 20th on a creditor's petition. Public examination, July 27th, at Bankruptcy Buildings, Carey Street, W.C.

W. Smith (W. Smith & Co.), electrical engineer, 12, Haden Road, Old Hill, Staffs.—Receiving order made May 20th on a creditor's petition.

G. E. Hughes, electrical engineer, 90, Gibbet Street, Halifax.—Public examination, June 17th, at the County Court, Prescott Street, Halifax.

A. C. Clewley (Radioland), electrical goods factor, 21, Portland Street, Walsall.—Public examination, June 23rd, at the Court House, Lichfield Street, Walsall.

W. C. Hannah, electrical engineer, 2, Percy Street, Hull.—Discharge suspended for two months until June 20th.

Company Liquidations

J. Cardash & Co., Ltd., Waterloo House, 155, Upper Street, N.—The statutory first meetings of this company were held recently at the Board of Trade Offices, Carey Street, before Mr. H. P. Naunton, Assistant Official Receiver. The winding up order was made on the petition of the Telsen Electric Co., Ltd., creditors for £513. The company attributes its failure to pilfering of stock by an employé and overhead charges, but in the opinion of the Official Receiver it was due primarily to bad management in disposing of goods at reckless prices regardless of commercial morality. The liabilities are returned at £1,423, and the only assets are book debts of doubtful value. The liquidation was left in the hands of the Official Receiver.

Leeds Electrical Construction Co., Ltd.—Meeting, July 2nd, at 1, Charmouth Street, Leeds, to receive an account of the winding-up by the liquidator, Mr. H. S. Rhodes.

L. Kremner, Ltd.—Winding up voluntarily. Joint liquidators, Mr. J. W. Shepherd, 78, King Street, Manchester, and Mr. C. Latham, New Oxford Street, W.C.

Sherborne Electric Supply Co., Ltd.—Winding up voluntarily. Liquidator, Mr. H. Fraser.

Private Arrangement

J. Marsh (trading as the Wesley Wireless & Electric Co.), 3, Wesley Street, and 82b, Old Park Lane, Southport.—At a meeting of creditors held recently at Southport, a statement of affairs submitted showed liabilities of £721, of which £631 was due to the trade and £40 to a cash creditor. There were also fully secured creditors for £25. The total assets amounted to £472, and after allowing £29 for preferential claims, the net assets were £443, or a deficiency of £277. It was decided that the debtor should endeavour to submit an offer of a composition of 6s. 8d. in the £, payable in cash, failing which the matter should be dealt with under a deed of assignment to Mr. J. A. Bond. A committee was also appointed, consisting of Mr. P. S. Booth and the representatives of the Northern Steel & Hardware Co., Ltd., and Super Radio (Lancs), Ltd.

Dissolutions of Partnership

J. E. & H. Shepherd & Co., electrical engineers, Blackfriars Road, Salford.—Messrs. A., H., S., and J. E. Shepherd have dissolved partnership so far as regards Mr. J. E. Shepherd. The remaining members of the firm will attend to debts and carry on the business.

Ridgeway Radio Co., radio instrument manufacturers, 2a, Ridge Avenue, Winchmore Hill.—Messrs. W. S. Dalgety and W. E. George have dissolved partnership. Mr. George will attend to debts and carry on the business.

Winding-up Petitions

In the Companies Court on Monday last Mr. Justice Eve had before him a petition for the winding up of Edison Bell, Ltd. The petitioning creditor's claim was for £1,627, and there were supporting creditors for £642. Counsel stated that negotiations were going on and the company desired to enter into a scheme of reconstruction. His Lordship directed the petition to stand over for four weeks.

On the same day Mr. Justice Eve heard a petition by Kelvin Construction Co., Ltd., of Maryhill, Glasgow, constructional engineers, for the compulsory winding up of Lowden Valves, Ltd. The judgment debt was £90.

The company did not appear, and his Lordship made the usual compulsory order.

Mr. Justice Eve heard a further petition by the Brook Radio Co., Ltd., of Christopher Place, Wigmore Street, for the compulsory winding up of Home Electrics, Ltd. The judgment debt was about £160.

The company was not represented, nor were other creditors. His Lordship directed the usual compulsory winding up.

Electricity Supply

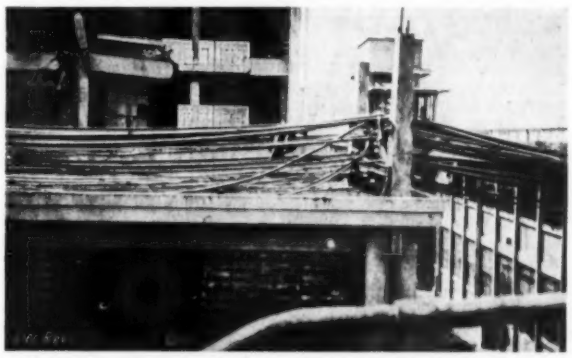
Lighting, Domestic, Power

Aberdeen.—LOAN SANCTIONED.—Sanction has been received to the borrowing by the Corporation of £73,000 for mains and services and sub-station equipment.

Aberystwyth.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation the Borth and Ynyslas Special Order authorising Mr. J. Butterworth and Mr. H. Goodman to supply electricity in the rural district of Aberystwyth.

Amersham.—CHEAPER ELECTRICITY.—The Uxbridge and District Electric Supply Co. has reduced the lighting charge in the rural district from 8d. to 5d. per kWh.

Argyle.—ELECTRICITY SCHEME.—The installation of electricity plant for public lighting and private consumption at Campbelltown, Tarbet, Ardishaig, and Lochgilphead is being considered. Engineers are investigating in the districts mentioned and will make a report to the County Council.



"Henley" cables holding their own in a cotton mill which was badly damaged during the recent disturbances in Shanghai

Australia.—FINANCIAL IMPROVEMENT.—Returns issued by the Minister of Railways for Western Australia show continued improvement in the financial results of operation of the Government tramways and electricity supply services. For the nine months ended March 31st the tramways showed a profit of £6,614, as compared with a loss of £6,526, while the electricity supply services made a profit of £14,137, as against a profit of £4,361.

Barking.—SUPPLY IMPROVEMENTS.—The Electricity Committee is to erect a sub-station and lay mains at a cost of £7,820 to improve the supply in the Longbridge district.

Barrow-in-Furness.—YEAR'S WORKING.—The annual reports upon the Corporation electricity undertaking for the year ended March 31st last show a very satisfactory position. There was a gross profit of £44,709, as against £40,139 in 1930-31, while the surplus for the year, after deducting loan charges and sinking fund, was £7,924, out of which had to be provided various capital items (£2,147) and depreciation of stores, &c. (£1,497), leaving the net profit at £4,280, as compared with £2,476 in 1930-31. The aggregate income was £4,655 more than the preceding year, on an additional output of 2,072,917 kWh, while the working expenses were £84 lower. Loan charges increased by £741 and depreciation in value of stores by £217. The income from the sales of fittings, wiring installations, &c., was £8,187, against an expenditure of £7,462, leaving a surplus of £725. The aggregate capital expenditure on the undertaking is now £616,488, of which £41,066 was spent during the year. Sales of energy increased from 19,077,412 to 21,148,710 kWh, the average price obtained falling from 1.222d. to 1.153d. per kWh. The maximum load was 6,800 kW, as against 6,350 kW.

Continental.—SWITZERLAND.—According to *Swiss Industry and Trade*, the production of electrical energy in Switzerland last year amounted to 3,780 million kWh, as against 3,680 million kWh in 1930, the increase being due to the "exports" which were 115 million kWh more than 1930. If the output of the hydro-electric stations of the Swiss Railways is added the production totalled 5,050 million kWh, of which 23 million kWh was furnished by steam stations and the rest by hydro-electric plants.

TURKEY.—The Société Turque d'Electricité, of Stamboul, has recently secured a concession to supply electricity for lighting and power purposes to 34 small communities in the district. A sumbarine cable has also been laid between the mainland and Scutari with the object of furnishing a supply to the islands of Buyuk-Ada and Heybeli-Ada.

Coventry.—CHARGES REDUCED.—The present maximum demand system for lighting in Coventry is as follows: For the first hour per day at the maximum demand, 7d. per kWh; for the second hour, 3½d.; for the remainder, 1½d. The Electricity Committee now recommends that the price, after the two hours maximum demand, be reduced from 1½d. to ¾d. per kWh. Consumers of electricity for shop lighting between the hours of 7 p.m. and 7 a.m. can still, if they desire, be charged at

the flat rate of 2d. per kWh. It is proposed to reduce the charge for electricity for domestic purposes other than lighting from 1½d. to 1d. per kWh, while as an alternative the adoption of the following two-part tariff is recommended: Inside the city, 12½ per cent. per annum of the rateable value of the property, plus ¾d. per kWh; outside the city, 15 per cent. per annum of the rateable value, plus ¾d. per kWh, the minimum rateable value in each case to be taken as £12. Low pressure power (now 1½d. per kWh, irrespective of quantity) is to be supplied as follows: Quarterly accounts: First 25,000 kWh per quarter, 1¼d. per kWh; second 25,000 kWh, 1½d.; above 50,000 kWh, 1d. Monthly accounts: First 8,000 kWh per month, 1¼d. per kWh; second 8,000 kWh, 1½d.; above 16,000 kWh, 1d.

Dover.—BULK SUPPLY CHARGES.—It was reported to the Town Council last week that the Central Electricity Board had now offered a bulk supply of electricity at not more than £3 15s. 6d. per kW, instead of £3 17s. 6d., and that this offer would secure for the Corporation absolute freedom from transmission line charges. The chief clerk of the Electricity Department is to consult with Mr. Highfield, the Council's expert, on the offer.

Eccles.—EXTENSION OF THE ASSISTED WIRING SCHEME.—The assisted wiring scheme is to be made applicable to houses in which one room is used for business purposes (without any structural alteration having been made) provided that the rateable value of such houses does not exceed £15 and that the supply is installed and used in all the occupied rooms therein. This figure of £15 rateable value is in substitution for that of £11, fixed last December.

Exeter.—EXTENSIONS.—The City Council has decided to apply for an Order authorising the extension of its electricity undertaking to include the parishes of Exminster, Kenn, Shillingford and Dunchideock. The area in question embraces about eighteen sq. miles, the total cost of the extensions being about £7,000.

Finchley.—LOANS.—The Electricity Committee has obtained sanction to a loan of £11,890 for sub-station and feeder extensions. Application is to be made for sanction to borrow a further £18,000 for mains and consumers' connections.

Fleetwood.—ELECTRICITY CHARGES.—The Urban District Council has referred to a special committee the question of reducing charges for electricity.

SUB-STATION EQUIPMENT.—Sanction has been received to the borrowing of £5,000 for sub-station equipment.

Glasgow.—MAINS EXTENSIONS.—The Electricity Committee recommends the laying of distributing mains at a cost of £787.

Hailsham.—SUPPLY TO BROAD OAK.—The Weald Electricity Supply Co., Ltd., has informed the Rural District Council that the supply is to be extended to Broad Oak, Heathfield, directly approval has been obtained to erect the necessary overhead lines.

Hampstead.—YEAR'S WORKING.—The statement of accounts of the Electricity Department for the year ended March 31st, 1932, shows a total revenue of £188,732 and a working expenditure of £139,409, as compared with £183,707 and £136,271 respectively for the previous year. The net profit increased from £5,456 to £14,284. The capital outlay during the year was £33,292, making a total of £966,101 (of which £317,270 has been written off) now spent on the undertaking. The sale of electricity increased from 25,471,474 to 26,449,806 kWh, with a maximum demand of 13,950 kW (450 kW more than last year). A total of 30,154,217 kWh was purchased in bulk.

Hawarden.—DEVELOPMENT OF UNDERTAKING.—The electrical engineer, Mr. A. Richardson, has recommended the Rural District Council to carry out a systematic canvass with the view of securing new consumers. A Fringe Order is to be obtained for a supply to Leeswood.

Hornsey.—BETTER LIGHTING.—The Electricity Committee is to improve the lighting of the Great North Road at a cost of £3,102.

Hull.—NEW SUB-STATION.—The Electricity Committee is to provide a sub-station in the Saner Street district at a cost of £2,816, and obtain a site for a sub-station in connection with the supply to Hesslewood Orphanage.

Irish Free State.—SHANNON SCHEME DEVELOPMENT FUND.—A White Paper was laid on the table of Dail Eireann last week showing the receipts and payments for the Shannon Power Development Fund up to March 31st, 1931. Out of the receipts £5,710,750 was advanced for the Central Fund, £600,000 for the redemption of bills by contractors, £2,367 for interest paid by contractors on extended bills, and £160,305 for the Electricity Supply Board in respect of extra works carried out at the Board's request. The grand totals under various heads were: Civil construction, £3,042,846; electrical construction, £2,152,660; general charges, £677,549; sums advanced to contractors on security of bills, £600,000; and balances, £810.

Isle of Man.—ELECTRICITY BILL.—The Manx Electricity Bill has now been passed by both branches of the Legislature. The Bill permits a public electricity board to supply electricity to all parts of the island except Douglas, a bulk supply being purchased from the Douglas Corporation. The Government is to assist by paying part of the interest and charges of the sinking fund during the first five years. The initial cost of installing the main transmission lines, &c., is estimated at £100,000. Energy will be distributed by overhead lines from Douglas through the principal towns of the island, supplying the various villages *en route*. The work will be started during the coming autumn.

Lancaster.—LOAN SANCTIONED.—The Electricity Department has received authority to borrow £15,800 for the new switchgear for supplying the works of Messrs. J. Williamson and Son, Ltd.; and £10,700 to provide new sub-station equipment and switchgear.

London.—ISLINGTON.—The Borough Council has received sanction to a loan of £94,000 for mains, services, sub-stations and meters.

ST. PANCRAS.—The Electricity and Public Lighting Committee recommends the improvement of the public lighting at a cost of £815, including mains extensions. It is also proposed to introduce a system of hire-purchase in connection with the supply of domestic electrical appliances on a three and five years' basis. Application is to be made for sanction to a loan of £510 for a h.p. main.

Luton.—LOAN.—The Town Council has applied for sanction to a loan of £34,092 for the following purposes: Extension of supply, Little Bramingham Road (£1,953); switchgear for new Bedford Road e.h.p. feeder (£916); feeder to Union Street (£1,222); mains (£20,000); house services (£5,000); meters (£5,000).

Macclesfield.—ACQUISITION OF UNDERTAKING RECOMMENDED.—The Electricity Committee recommends the Town Council to proceed with the acquisition of the electricity undertaking. Owing to the wide difference in the respective valuations—that of the Corporation being £223,000, and that of the company £384,984—the Committee has decided to submit the matter to arbitration.

Maidstone.—EXTENSIONS.—The Corporation is to raise a loan of £10,000 in connection with the supply to consumers, including £2,400 for mains extensions in connection with the supply to the Coxheath area. Mains extensions are also to be carried out in Queen's Road and Heathfield Road at a total cost of £925.

Manchester.—YEAR'S WORKING.—The report of the Electricity Committee for the year ended March 31st last shows a net surplus of £43,332. The total revenue showed a net increase of £67,224, or 3.8 per cent., while the number of consumers increased by 8,598 (the highest figure ever recorded), bringing the total connected to 76,375. In spite of a further serious decline of 7.7 million kWh in engineering works consumption, supplies for industrial power, as a whole, showed a particularly encouraging increase of 2.4 million kWh. Good progress has been made in the use of electricity for commercial baking and cooking, while there is a growing appreciation of the advantages of electric heating for many applications in commerce and industry.

WIRING OF BARRACK STREET HOUSES.—The Corporation housing director has been instructed to arrange for the whole of the ninety tenement dwellings in Barrack Street to be wired for electricity.

Petersfield.—ASSISTED WIRING.—The Urban District Council has requested the Workmen's Housing Association to install electric lighting in houses in Highfield Road, the cost to be paid for on the hire-purchase system.

Rawtenstall.—LOAN.—The Electricity Committee is to apply for permission to borrow £10,000 for new services and £2,500 for meters.

SUB-STATION.—The Central Electricity Board is to erect a sub-station in Bacup Road, Hareholme.

Richmond (Yorkshire).—ELECTRICITY FOR NEIGHBOURING VILLAGES.—The Rural District Council has received a communication from the Cleveland and Durham County Electric Power Co., stating that it is proposed to give supplies of electricity to Catterick Village, Citadella, Brompton-on-Swale, Catterick Camp shopping area, Richmond Road, and Shute Road, Hipswell and Solburn Lodge Estate. A supply is to be made available at Walkerville when there was a sufficient demand for it.

St. Helens.—CHEAPER ELECTRICITY.—It is proposed to reduce the charge for power from 2.2d. to 2d. per kWh, consumers taking over 100 kWh per month being supplied at 1d. instead of 1.1d. per kWh. The lighting flat rate will be reduced from 4d. to 3½d. per kWh.

Saffron Walden.—LOAN.—The Electricity Committee is to apply for sanction to a loan of £1,000 for a new battery, feeder main, meters, a cable to the pumping station and services.

Spilsby.—OVERHEAD LINES.—The Mid-Lincs Electric Supply Co. has applied to the Rural District Council for permission to erect an 11,000-V overhead line from Midville sub-station to Alford, with a spur line to Spilsby. In reply to an inquiry by the Council as to whether spurs from the line would be taken to any of the villages upon the route, the company has replied that there would be one to Skendleby, but nothing could be decided with regard to the others, as there was such a large amount of compulsory work to do first, and small villages could not be supplied in the first stage.

Stoke-on-Trent.—EXTENSIONS.—The Electricity Committee has agreed to provide mains and services at the Kingsfield site, Basford, at an estimated cost of £450, if the Housing Committee is prepared to undertake the wiring of the whole of the houses on the estate for lighting purposes. The Elec-

tricity Committee also recommends the provision of sub-station equipment and mains at Oakhill (£10,955) and Tunstall (£4,750).

SUPPLY IN CHELL GREEN.—The borough electrical engineer has been instructed to proceed with the laying of underground and overhead mains, &c., to supply premises in Biddulph Road, Chell Green, at an estimated cost of £1,050, provided that 32 applicants will undertake to take supplies immediately.

EXTENSIONS.—The Electricity Committee has decided to spend £1,700 on the provision of mains and sub-station equipment in connection with the electrification of Longport Mills.

Thornton Cleveleys.—LOANS.—The Urban District Council has decided to apply for sanction to loans of £5,000 for mains and services and £2,000 for meters.

Tottenham.—COUNCIL HOUSE SUPPLIES.—The North Metropolitan Electric Power Supply Co. has notified the Urban District Council that the "current limiters" installed at some Council houses did not supply sufficient electricity on such occasions as week-ends and holidays, and the company therefore proposes, where desired, to install meters in place of "limiters" and charge tenants for any energy consumed in excess of 50 kWh in each winter quarter and 20 kWh in each summer quarter at the rate of 1d. per kWh.

Venezuela.—HYDRO-ELECTRIC SCHEME.—It is reported that a scheme is under consideration for the utilisation of Lake Maracaibo in the oil-producing district of Venezuela for the generation of electricity. The lake is over 800 ft. in depth and covers an area of approximately 236,000 sq. ft., and its surplus water flows to the sea along a channel nearly four miles wide and varying in depth between 10 and 16 ft. It is estimated that 775,000 h.p. is available.

Wimborne.—EXTENSIONS.—The Bournemouth and Poole Electricity Supply Co., Ltd., is about to extend mains to Charlton Marshall, Sturminster Marshall, Spetisbury, and Bere Regis, and there are also to be extensions to Kinson, Ferndown, West Moors and Stapehill.

West Mersea.—PUBLIC LIGHTING.—Electric street lighting is to be installed by the Colchester Corporation Electricity Supply Department.

Traction

Bradford.—NO PROTECTION FOR TRAMS.—The Ministry of Transport inspector has decided not to allow protection of the tramways by means of prohibition or protective fares against omnibus services.

Continental.—BELGIUM.—The Senate Commission on Transport has just issued a report on the budget of the Ministry of Transport, dealing very largely with the question of the electrification of the railways. It is stated that the National Railway Company has been investigating the problem of converting the lines from Luxemberg and the Ourthe, and offers from Belgian firms for the equipment of the lines and the sub-stations are now being examined. In the meantime the electrification of the Brussels-Antwerp line is also being studied, in which respect the work is being facilitated by the investigation concerning the lines from Luxemberg and the Ourthe. The examination consequently applies so far to the lines termed the Loba (Luxemberg-Ourthe-Brussels-Antwerp). It is calculated that the present working expenses of the Loba with steam locomotion amount to 193 million francs per annum, but that they would be reduced under electric traction to 129 million francs, the difference being sufficient at the rate of 10 per cent. to meet the interest and redemption charges on the cost of electrification of these lines, which is estimated at 631 million francs.

Derby.—TROLLEY-BUS TRIALS.—The Tramways Committee has decided to purchase three trolley-buses of different makes before making further purchases.

Exeter.—ELECTROMATIC TRAFFIC SIGNALS.—The Watch Committee is considering the adoption of "Electromatic" vehicle-actuated traffic control, similar to that employed in Cornhill, London. Following a demonstration by the Automatic Electric Co., Ltd., the Committee recommended the installation of signals at Southernhay East-Barnfield Road at a cost of £333.

Japan.—FURTHUR ELECTRIFICATION PLANS.—It is reported that the I.G.R. is considering the electrification of another section of the State Railway between Osaka and Otsu. It is proposed to erect a 6,000-kW sub-station at Kyoto, the total cost of the scheme being estimated at 3,000,000 yen.

Liverpool.—TRAILERS.—The Tram and Motor Omnibus Committee proposes to run trailers behind trams during rush hours.

London.—TRAMWAY EXTENSIONS.—The Metropolitan Electric Tramways, Ltd., are to reconstruct the tracks from South Tottenham Station to Hackney boundary, and also from Candler Street to the Stoke Newington boundary.

Newcastle-upon-Tyne. — RECONDITIONED TRAMCARS. — The Transport Committee recently inspected one of the old single-deck tramcars belonging to the Corporation which has been reconditioned under the supervision of Mr. T. P. Easton, tramways manager, at a cost of £220, including new motors. The car is fitted with upholstered seats in a double compartment, and has a considerably higher speed than the old vehicles. It is stated that six of these cars can do the work of seven of the older type.

Communications

Ceylon.—TELEPHONY.—Imperial and International Communications, Ltd., have proposed to the Government the formation of a Ceylonese company, with a capital of ten million rupees, for developing the Ceylon telephone system under Government authority. Sir William Barton, representing the Eastern Telegraph Co. and the Communications Company, recently visited Ceylon and made an offer to the Executive Committee of Communications and Works, says *Indian Engineering*, and it is believed the Executive Committee postponed consideration of the matter for six months to enable Sir William to make a fresh proposal as the Committee considered the offer inadequate. It is also understood that Sir William made a proposal in connection with the Ceylon Government's radio-telephone-telegraph programme.

China.—AUTOMATIC TELEPHONY.—Nanking is now served by a modern telephone equipment, the three exchanges, Central, North, and Hsiakwan, having been recently changed over to Strowger automatic operation. Two other exchanges, Pukow and Puchen, remain manual for the present, but are soon to be converted. The Central exchange has been equipped for 3,000 subscribers and the other two for 1,000 each. Self-aligning plunger-type line switches are used, being mounted on units having a capacity of one hundred line switches on one side, with the associated connector switches mounted on the opposite side. Each primary line switch unit of one hundred lines is equipped for peg count registration of all originating and terminating calls, thus providing for traffic records. The secondary line switches are mounted on single-sided racks having a capacity of six shelves of twenty line switches per shelf.

Germany.—"WIRING" FROM TRAINS.—Passengers on all fast trains can now send telegrams of not more than fourteen words to any station in the country by handing them to the conductor. A telegraph service was inaugurated experimentally from a certain train in Germany last year, and its success has led to its extension to the whole system.—*Reuter* (Berlin).

Glasgow.—RADIO EXCHANGES.—The Streets Committee, having considered seven applications for permission to establish broadcast exchange radio services in the city, has recommended that an inspection should be made of the system in actual operation in other towns before coming to any decision on policy.

Great Britain.—ANGLO-CONTINENTAL TELEPHONY.—Preparations are being made for the laying of additional cables to connect the British with the French and Belgian telephone systems, and the building of a new repeater station at St. Margarets-at-Cliffe, on the coast near Dover, is to commence at once.

India.—LONG-DISTANCE TELEPHONY.—Considerable progress has been made with the plans for linking by telephone the various provincial capitals of India with the seat of the Central Government. The link between Madras and Delhi will be the longest direct trunk connection in India. The Bombay-Calcutta direct trunk circuit has already been tested successfully. The next step will be an early attempt to link India to London.—*Reuter* (Simla).

Italy.—RADIO CENSUS.—A special census of radio apparatus is being held in Italy, all owners of sets being obliged to obtain a form at a post office and send in the particulars. The Italian Broadcasting Corporation announces that there is no other motive behind this measure than to furnish data of utility to manufacturers. The maximum penalty for not reporting a set, whether in use or not, is £14. Some 200,000 subscribers each pay the equivalent of £1 a year for a licence. By way of encouragement, says the *Daily Telegraph*, the licences issued at the beginning of this year entitled each holder to a lottery ticket with a motor-car as first prize.

United States.—TAXING COMMUNICATION.—The taxation of telephone, telegraph, and wireless messages has been approved by the U.S. Senate, newspapers and Press associations being exempt.

An aerial view of the Ironbridge power station of the West Midlands Joint Electricity Authority, the first part of which is approaching completion

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Abergele.—June 13th. Abergele and Pensarn Urban District Council. Electrically driven pumping plant. Mr. R. Green, 37, Bennett's Hill, Birmingham (deposit £3 3s.).

Arbroath.—June 8th. Town Council. Electrical work at fifteen blocks each of four three-apartment houses. Messrs. Carver & Symon, 11, Brothock Bridge, Arbroath (deposit £1 1s.).

Australia.—SYDNEY.—June 20th. Department of Public Works. Electrically driven pumping plant for Newcastle sewerage works. (G.X. 11522.)*

October 17th. City Council. Four three-circuit power transformers for Pyrmont power station. Construction engineer, Electricity Department (deposit £1 plus sales tax).

Cheadle and Gatley.—June 7th. Electricity Department. Transformers, switchgear and cable. (May 20th.)

Cleethorpes.—June 10th. Urban District Council. Switchgear, transformer, l.p. cables, &c. (May 27th.)

Dumfries.—June 11th. County Council. Electric lighting and heating work at new academy at Moffat. County clerk.

Durham.—County Education Committee. Installation of electric lighting at Washington Biddick Council School. Mr. F. Willey, 34, Old Elvet, county architect.

East Ham.—June 14th. Education Committee. Installation of electric lighting at Shaftesbury and Storey Street Schools. (May 20th.)

East Lothian.—June 13th. County Council. Electric lighting work in 116 houses. County architect, Property and Works Department, Haddington.

Egypt.—CAIRO.—June 15th. Ministry of Public Works. Electrically driven fuel oil pumping set. (G.X. 11490.)*

June 25th. State Domains Administration. Wire for use with power presses. (G.X. 11535.)*

Fife.—June 11th. County Council. Electric lighting installation at Limekilns housing scheme. Mr. Peter Reid, architect, Inverkeithing (deposit £1 1s.).

Glasgow.—June 8th. Education Department. Electrical work at Knightswood (new) school. Education offices (Property Department), 129, Bath Street (deposit £1 1s.).

Horsham.—June 27th. Electricity Department. Construction and erection of e.h.p. overhead lines. (See this issue.)

High Wycombe.—June 23rd. Corporation. Electrically driven pumping plant for Pann Mill Waterworks. Mr. W. Vaux Graham, 5, Queen Anne's Gate, S.W.1 (deposit £5).

London.—CENTRAL ELECTRICITY BOARD.—June 6th. 33-kV switchgear for the South West England and South Wales Scheme. (May 13.)

METROPOLITAN WATER BOARD.—June 17th. Stores, including electric lamps. Chief engineer, 173, Rosebery Avenue, E.C.1.

Manchester.—June 20th. Electricity Department. One 6,000-kVA static transformer. (See this issue.)

Menston.—June 20th. West Riding Mental Hospitals Board. Electric lighting installation in part of the Menston Mental Hospital. Mr. W. E. H. Burton, architect and engineer to the Board, Wakefield (deposit £1).

Mexborough.—June 13th. West Riding Education Committee. Electric lighting at new junior school. Education officer, County Hall, Wakefield.

New Zealand.—WELLINGTON.—July 27th. Post and Telegraph Department. Battery plates. (A.X. 11355.)*

Nottingham.—June 21st. Electricity Department. General stores. (See this issue.)

Sheffield.—June 6th. Corporation Tramways and Motors. Traction lamps, cables, armature coils, commutators, &c. Mr. A. R. Fearnley, general manager, Division Street.

South Africa.—CAPETOWN.—July 7th. City Council. L.p. metal-clad switchgear. (A.X. 11354.)*

Swinton and Pendlebury.—Urban District Council. Showcards and advertising matter. (See this issue.)

Uruguay.—MONTEVIDEO.—July 25th. State Electricity Supply and Telephone Administration. Ten transformer sub-station switchgear equipments. (A.X. 11359.)*

West Midlands.—June 15th. Joint Electricity Authority. 11-kV overhead lines. (See this issue.)

West Riding.—June 13th. County Council. Installation of electric lighting at the Maltby infant school and the Whitwood Mere senior school. Education officer, County Hall, Wakefield.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Bexhill. — Electricity Committee. Recommended. Two Hewittic rectifier equipments (£1,595 each).—Hewittic Electric Co., Ltd., E.h.p. cable (£870) and four straight through joint boxes (£18).—W. T. Glover & Co., Ltd. 300-amp. feeder panel (£174), isolator equipment (£162), extension type switch fuse (£79).—A. Reyrolle & Co., Ltd.

Durham.—County Education Committee. Accepted. Installation of electric lighting at Marley Hill Colliery Council School (£96), Whickham Council School (£171), and Haverton Hill Council School (£234).—F. Reid, Ferens & Co. Electrical installation at the Marley Hill Council School (£40).—Devereux, Moodie & Co.

Glasgow.—Education Committee. Recommended. Electric heating at St. Anne's School (£238).—R. & G. Sinclair (Glasgow), Ltd.

Transport Committee. Recommended. Electrical fittings for Knightswood Garage.—Simplex Conduits, Ltd. Switchgear (truck type cubicles) for sub-stations.—Metropolitan-Vickers Electrical Co., Ltd.

Halifax.—Town Council. Accepted. Installation of electric lighting in houses at Shay Lane (£79) and at Shibden Grange (£117). J. Pilling & Co.

Hornsey.—Electricity Committee. Recommended. Switchgear for Muswell Hill sub-station (£396) and feeder breakers for Priory Road sub-station (£46).—Park Royal Engineering Co., Ltd. Two breakers for feeder boards at Oakfield Road sub-station (£62).—Bertram Thomas.

Huddersfield.—Town Council. Accepted. Two tramcars.—English Electric Co., Ltd.

Hull.—Telephones Committee. Accepted. Electric lighting installation at central automatic exchange (£70).—G. M. Kettlewell.

Electricity Committee. Accepted. Cables.—Derby Cables, Ltd.

London.—CITY HIGHWAYS COMMITTEE. Recommended. Battery for meter testing office (£185).—Tudor Accumulator Co., Ltd.

STOKE NEWINGTON.—Electricity Committee. Installation work.—A. R. Camidge & Co., Ltd. (in place of withdrawn tender).

Salford.—Electricity Committee. Recommended. 12,500-kVA transformer (£3,190).—Vickers Electrical Co., Ltd.

Sheffield.—Corporation Tramways Committee. Accepted. Six pairs of tramcar controllers, type 510 E (£86 per pair) and 15 pairs lightweight type traction motors (£306 per pair).—Metropolitan-Vickers Electrical Co., Ltd.

West Hartlepool.—Electricity Committee. Accepted. Cable for the ensuing year.—Callender's Cable & Construction Co., Ltd.; Derby Cables, Ltd.; Enfield Cables, Ltd.; Macintosh Cable Co., Ltd. Kiosk sub-station.—Crompton Parkinson, Ltd. Transformer in connection with supply to the new isolation hospital.—British Electric Transformer Co., Ltd.

Forthcoming Events

Institution of Electrical Engineers.—*(London Students' Section).*—Saturday, June 4th. Summer outing to s.s. *Empress of Britain* at Southampton Docks. *(South Midland Students' Section).*—Saturday, June 4th. 2 p.m. Visit to Ironbridge power station.

Royal Institution.—Friday, June 3rd. Institution, London. 9 p.m. "Electrical Conductivity of Metals at the Lowest Temperatures. Mr. J. E. M'Lennan.

Electrical Association for Women.—Thursday, June 9th. 1 p.m. Visit to Mrs. G. Z. de Ferranti's electric farm, Upper Basildon, Pangbourne.

Incorporated Municipal Electrical Association.—June 15th-18th. Cardiff. Annual convention.

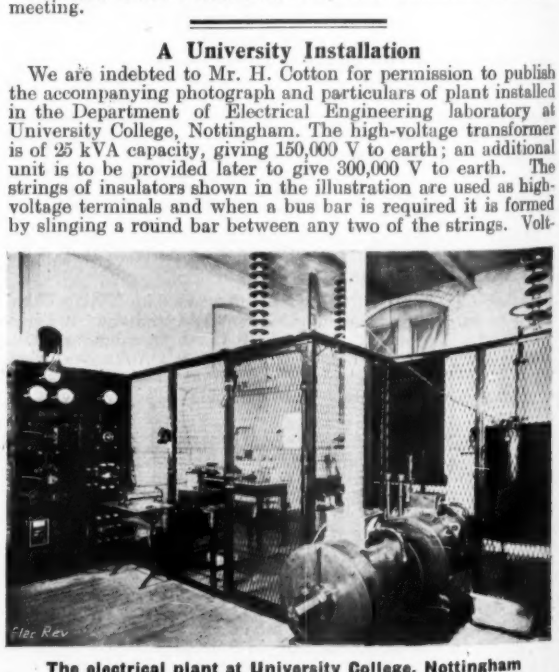
Municipal Tramways and Transport Association, Inc.—June 22nd-24th. Grand Hotel, Eastbourne. Annual conference.

Electrical Contractors' Association.—June 28th-30th. Southport. Annual conference.

Overhead Lines Association.—July 1st. Chesham. Summer meeting.

A University Installation

We are indebted to Mr. H. Cotton for permission to publish the accompanying photograph and particulars of plant installed in the Department of Electrical Engineering laboratory at University College, Nottingham. The high-voltage transformer is of 25 kVA capacity, giving 150,000 V to earth; an additional unit is to be provided later to give 300,000 V to earth. The strings of insulators shown in the illustration are used as high-voltage terminals and when a bus bar is required it is formed by slinging a round bar between any two of the strings. Voltage regulation can be carried out by means of a regulator in the field circuit of the alternator or by Ward-Leonard control of the machine's field. The left-hand panels of the switchboard, which are made of "Sindanyo" asbestos insulating board, "ebony grade" (Turner's Asbestos Cement, Ltd.), are for the control of the alternator which energises the high voltage transformer, while the right-hand panels are used for altering the circuit arrangement on the primary side of the transformer.



The electrical plant at University College, Nottingham

Notes

Mining Electrical Engineers

The annual convention and summer meeting of the Association of Mining Electrical Engineers is to be opened in Glasgow this year with an informal gathering on June 20th. During the following week visits to electrical firms in various parts of West Scotland will take place, and a journey to Edinburgh for further inspection and a pleasure trip to Loch Long and Loch Lomond have been arranged. The dinner and dance will be held on the Friday, when it is hoped that the Lord Provost of Glasgow will be present.

The annual general meeting of the South Wales and West Wales branches of the Association of Mining Electrical Engineers was held at Porthcawl last Saturday. Major W. Roberts, the retiring chairman, presided, and he was supported by Major E. Ivor David (president of the Association) and Mr. E. F. Cope (chairman, West Wales branch). In his annual report Mr. H. J. Norton (hon. secretary) said that the old Western sub-branch had grown to such an extent that it had attained the status of a full branch known as the West Wales branch. The membership at March 31st was 453, 83 new members having been enrolled during the year. The Association's third prize for papers read throughout the country had been awarded to Mr. J. Vaughan-Harris for his paper on "Earthing of Electrical Apparatus," and a branch prize had also been awarded to him. Mr. W. A. Hutchings had also received a branch prize for his paper, "Safety and Efficiency in Mines."

A Novel Ferry

An experiment in marine transportation is announced here by the American General Electric Co. The installation has been made across the Sacramento River, and the ferry has operated near Princeton at a cost of approximately one-half that incurred with the old petrol engine-powered craft. This electrically driven road ferry is municipally operated and is maintained by Glenn and Colusa counties, which it serves. The new installation is distinctive in that the up-river cable by which it hauls itself across the river also acts as the trolley wire supplying power for a single-phase motor. The cable has to be dropped to the bottom of the river in order to permit river traffic to pass up and down. A trolley wire must be bare for a trolley wheel to make contact with it, but if such a cable touched the water while carrying current it would immediately be short-circuited. The General Electric engineers insulated the cable at each end with a device which automatically shuts off the current when the cables are lowered to the water. The speed of the boat is approximately 180 feet per minute, and the crossing of the river elevation is made in about two minutes. The ferry carries twelve cars.

Electrical Association for Women

A branch of the Electrical Association for Women has been established at Eastbourne. In the course of an inaugural address, Miss C. Haslett, Director of the Association, indicated what had already been done to bring to the fore the women's point of view regarding tariffs, electric cookers, and appliances, and to bridge the gap between electrical engineers and consumers. Their views had been brought to the notice of the Central Electricity Board with regard to tariffs, the manufacturers' associations with regard to appliances, and the Board of Education in relation to instruction on electrical matters in schools. Ald. R. S. Chatfield, chairman of the Eastbourne Corporation Electricity Committee, said that they would be glad to give the branch every assistance and encouragement. Miss Cuthbertson was appointed hon. secretary of the new branch.

Earlier Technical Education

In the course of his presidential address at the recent annual conference of the Association of Teachers in Technical Institutions at Cardiff, Mr. S. H. Moorfield advocated the commencement of technical education at eleven years of age. He recommended the inclusion of junior technical, commercial, and domestic schools in the educational system.

Polar Lights

A popular lecture on "Polar Lights" was delivered on May 25th by Prof. Sydney Chapman, under the auspices of the British Science Guild, at the Royal Society of Arts. Aurorae, it was pointed out, are to be seen most often in the northern and southern polar regions; they rarely, or never, occur near the equator, though when specially intense they appear in much lower latitudes than usual. They generally extend downwards to about fifty miles height in the atmosphere, and sometimes extend upwards for 400 or even 500 miles. Their form and colour are often very beautiful; the most usual colour is a pale yellowish-green, but violet, grey, and vivid red are also seen. In form they are very varied. As to their cause, much remains mysterious, but it seems likely that polar lights are due to electrified particles shot out from the sun, which, when coming near the earth, are deflected by the earth's magnetic field towards the polar regions. There they enter our atmosphere, and break up or disturb the atoms or molecules which they meet in their long downward path till their momentum is exhausted. The disturbed atoms and molecules in the air, while spontaneously returning to their normal states, emit the light which we see as the aurora.

Visit Abandoned

Owing to the "exceedingly small number of applications received" by the secretary, the summer meeting visit of the North Midlands Students' Section to Hull Docks, which was to have taken place on June 1st, had to be abandoned.

The Institute of Physics

When opening the new reading rooms at the Institute of Physics on May 24th, Lord Rutherford, president, explained that they were provided to give greater opportunities to members to meet each other. Also, by the co-operation of the Physical and Optical Societies and the other participating societies, a large number of books and periodicals had been provided. The intention was to gather together a small library of text and reference books, and the nucleus of such a library already existed.

At the annual general meeting of the Institute held immediately afterwards, Lord Rutherford said that remarkable progress had been made in the short time since the foundation of the Institute. The importance of physics, not only as an academic subject but as a profession of value to the outside world, was being rapidly recognised.

Appointments Vacant

Combustion engineer and chemist for Nottingham Electricity Department.

Assistant mains engineer, assistant sub-stations superintendent, testing engineer and two sales assistants, for the Belfast Electricity Department.

Lady demonstrator for Southend-on-Sea Electricity Department.

(See our advertisement pages to-day.)

An Hotel Electrical Installation

Following a severe outbreak of fire last Boxing Day, the St. Austell Bay Hotel was rebuilt, refitted, and refurnished by May 6th this year. The electrical equipment was supplied by Messrs. J. H. Deeble & Sons, Ltd., of Falmouth. The total loading is 400 A on a three-phase system, G.E.C.-Pirelli cable being used throughout. The M.E.M. fuseboards and "Deeble" surface switches are also manufactured by the G.E.C. The installation consists of about 600 lighting points, 82 light signals worked from a transformer, ten G.E.C. portable prepayment meters and nine clocks controlled by a master "Pulsynetic" clock. Fifty bedrooms are fitted with heating points, and public rooms are fitted with a modern bell system

The St. Austell Bay Hotel

with G.E.C. electrical replacement indicators. There are two 1,000-c.p. G.E.C. floodlights, and nine 10-line G.E.C. intercommunication telephones. There is a still-room fitted with a 5-kW grill and 1-kW boiling ring, while the kitchen is equipped with a 7½-kW pastry oven and a 5-kW grill, the pastry room being fitted with a 3-kW boiling ring. The equipment includes an electrical refrigerator by West & Beynon, and an electric ice-cream machine, while the G.E.C. hotplates for the dining room and services have a loading of 600 W each. An 11-h.p. motor for a salt-water pump raising water from the sea is provided, and also a 7-h.p. electric passenger lift and a 1-h.p. service lift.

Safety in Mines

The Secretary for Mines announces the publication of the 1932 edition of the reference book entitled "Coal Mines Act, 1911: Regulations and Orders relating to Safety and Health." (Stationery Office, 1s. 6d. net). The regulations and orders of a general nature which were in force on January 1st, 1932, are collected together in this volume in a convenient form for the use of mine officials and others concerned with safety and health in mines. The book also contains lists of approved safety lamps and safety lamp glasses, as well as memoranda dealing with the testing of safety lamps and rescue apparatus.

Our Service Department

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the name and address of the makers of the following:—

THEBEN time switch.

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

I.E.E. Council Nominations. — Professor E. W. Marchant, D.Sc. (an outline of whose career appears on page 806), has been nominated by the Council of the Institution of Electrical Engineers as president for the next session. Other Council nominations are Mr. H. T. Young (governing director, Messrs. Troughton & Young, Ltd.), vice-president; Mr. P. Rosling (late general manager, Messrs. W. T. Henley's Telegraph Works Co., Ltd.), hon. treasurer; and Mr. T. Carter (Messrs. A. Reyrolle & Co., Ltd.), Professor J. K. Catterson Smith (King's College), and Mr. H. W. H. Richards (L. & N.E.R.) as ordinary members of Council, with Mr. W. S. Burge (C.E.B.) to represent the Associate Members. The retiring members of the Council are Capt. J. M. Donaldson (president), Mr. B. Welbourn (vice-president), Mr. E. Leete (hon. treasurer), and Messrs. A. R. Cooper, R. S. Whipple, and E. E. Sharp (ordinary members), together with twelve past-chairmen of local centres and sections.

Mr. H. T. Young, nominated vice-president of the I.E.E.

At the annual meeting of the Institute of Physics it was announced that the new board, which will take office on October 1st next, would include the following:—President: **Lord Rutherford**; vice-president: **Dr. C. V. Drysdale**; non-official members: **Prof. W. L. Bragg, Sir Richard Gregory, Messrs. R. A. Watson** and **R. S. Whipple. Mr. G. Shearer** was nominated by the British Institute of Radiology. Sir William Bragg was elected honorary fellow of the Institute.

The Institute of Physics announces that the B.O.I.M.A. prize for the best paper published in the Journal of Scientific Instruments during the year 1931 is to be equally divided between **Mr. H. C. H. Townend**, of the National Physical Laboratory, for his paper on "A Daylight Factor Integrator," and **Professor E. W. Marchant, Mr. J. K. Burkitt**, and **Mr. A. H. Langley**, of the University of Liverpool, the joint authors of the paper, "A Portable String Galvanometer for use at Moderate Frequencies."

Mr. S. Evans, late sales manager of Messrs. S. G. Leach and Co., Ltd., has been appointed London manager of Messrs. Ward & Goldstone, Ltd., in place of Mr. A. G. Jones, who has resigned.

Mr. L. J. Kettle has been elected president of the Institution of Civil Engineers of Ireland for the current year.

Mr. C. R. Belling (Belling & Co.), Mr. W. H. Bulpitt (Bulpitt and Sons, Ltd.), and N. W. Gilbert (Berkeley & Young, Ltd.), amusing themselves on the deck of the s.s. "Orontes" at Dubrovnik on the Mediterranean

Sir Holberry Mensforth, chairman of the English Electric Co., Ltd., who with Lady Mensforth and Miss Mensforth has been visiting South Africa, sailed for England on May 30th.

Mr. H. M. Goldstone, of Messrs. Ward & Goldstone, Ltd., has resigned from the board of Messrs. Remax, Ltd.

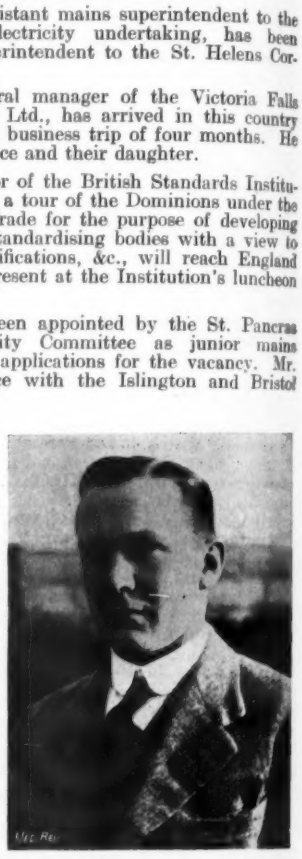
Mr. T. S. Parkinson, assistant mains superintendent to the Blackburn Corporation electricity undertaking, has been appointed distribution superintendent to the St. Helens Corporation.

Mr. Bernard Price, general manager of the Victoria Falls and Transvaal Power Co., Ltd., has arrived in this country on a combined holiday and business trip of four months. He is accompanied by Mrs. Price and their daughter.

Mr. C. le Maistre, director of the British Standards Institution, who has been making a tour of the Dominions under the auspices of the Board of Trade for the purpose of developing co-operation between the standardising bodies with a view to Empire unification of specifications, &c., will reach England on June 6th, and will be present at the Institution's luncheon on June 9th.

Mr. E. A. Phillips has been appointed by the St. Pancras Borough Council Electricity Committee as junior mains assistant. There were 255 applications for the vacancy. Mr. Phillips has had experience with the Islington and Bristol electricity undertakings.

Mr. G. Dixon, who, as reported in our issue of May 13th, has been appointed to the post of assistant engineer to Mr. W. Frisby, borough electrical engineer of Colchester, was for a number of years assistant to Mr. C. C. Hawtayne, consulting engineer. The post is a new one, and has been created owing to the rapid growth of the Electricity Department since the Hythe station was first opened in 1925. Electricity is now supplied to forty-six towns and villages, and it is estimated that ten million kWh will be sold during the current year, as compared with 2¼ million kWh during the first year.



Mr. G. Dixon, assistant engineer at Colchester

Mr. G. Dalby, of the Edison Swan Electric Co., Ltd., held a ticket in the Irish Derby Sweep and drew "Dastur," which ran second. He therefore will receive £15,000, but we understand that he had sold a half share in the ticket.

Obituary

Sir William Bowater.—The death is announced of Sir William H. Bowater, which occurred in Birmingham on May 30th at the age of seventy-seven. He was chairman of Messrs. Parker, Winder & Achurch, Ltd.

Mr. J. H. Hammond.—The death is reported of Mr. J. H. Hammond, K.C., at Sydney, Australia. He was chairman of the Royal Commission on Wireless which submitted its report in 1927, and was also a member of the Broadcasting Advisory Committee which was appointed by the Australian Government in 1928 to formulate plans for the development of broadcasting.

Mr. T. H. Large.—The death is announced at the age of 79 years of Mr. Thomas H. Large, who was for about twenty years on the staff of the Ayr Corporation Electricity Department.

Mr. C. A. L. Prusmann.—We regret to record the death of Mr. C. A. L. Prusmann, which occurred on May 19th at Withington, near Manchester. He was formerly borough electrical engineer at Swansea, and retired from that position in 1914.

Mr. S. G. Lang.—In our last issue we recorded the death of Mr. S. G. Lang. He entered the service of British Insulated Cables, Ltd., in the Contract Department, in February, 1910, having previously had extensive experience of tramway overhead equipment and track work with Messrs. R. W. Blackwood & Co., British Electric Equipment Co., and G. Wimpey & Co. He carried out many important overhead line contracts for B.I. Cables. In June, 1930, he developed serious heart trouble, and retired from the company's service in July, 1931.

Will.—Sir Arthur Duckham, who was chairman or director of a number of companies connected with fuel and engineering, and the president-elect of the Federation of British Industries, left £78,338 (net personalty £28,674).

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Dorman Long & Associates (China), Ltd.—Private company. Registered May 25th, with a nominal capital of £100 in £1 shares. Objects: To adopt an agreement with Dorman Long and Co., Ltd., Beyer, Peacock & Co., Ltd., Metropolitan-Vickers Electrical Co., Ltd., Callender's Cable & Construction Co., Ltd., and other companies, to acquire any real or personal property, patents, licences, rights or privileges, to erect, construct, maintain and alter any buildings, works, ships, stores, plant and machinery. The subscribers are: C. Mitchell, 55, Broadway, Westminster, S.W.1 (chairman, Dorman Long and Co., Ltd.), and Sir Felix J. C. Pole, Crown House, Aldwych, W.C. (chairman, Metropolitan-Vickers Electrical Co., Ltd.). Solicitors: Lawrence, Messer & Co., 16, Coleman Street, E.C.

Gray, Dallen & Co., Ltd.—Private company. Registered May 20th. Capital, £1,000 in 800 ordinary shares of 10s. each and 600 7½ per cent. non-cumulative participating preference shares of £1. Objects: To carry on the business of electrical, wireless and gas engineers and factors, &c. The first directors are: F. L. Gray, "Brookshide," Wimborne Road, Bead Cross, Dorset; C. H. Gray, 116, Lowther Road, Bournemouth; J. R. Dallen, "Wandilla," Wimborne Road, Ensbury, Bournemouth; W. Hurley, 5, Blighmont Crescent, Southampton; and J. Nobes, 21, Oak Road, Redbridge, Southampton.

Chatterton & Keen, Ltd.—Private company. Registered May 26th. Capital, £1,000 in £1 shares. Objects: To acquire the business of manufacturers and suppliers of radio and television apparatus, carried on by P. V. Chatterton and C. Higgs, at 11, 12 and 13, Chandos House, Palmer Street, Westminster. The permanent directors are: P. V. Chatterton, 90, Clarendon Road, Putney, S.W.15, and C. Higgs, 73, New Church Road, Hove. Registered office: 11, 12 & 13, Chandos House, Palmer Street, Westminster.

Lamberhurst Electric Supply, Ltd.—Private company. Registered May 23rd. Capital, £2,500 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, &c. The directors are: T. H. Minshall, 9, Melbury Road, Kensington, W.14, and N. W. S. Halsey, Mount Horan, Lamberhurst, Kent. Secretary: R. C. Powell. Registered office: 34, Victoria Street, S.W.1.

Lionel Robinson & Co., Ltd.—Private company. Registered May 27th. Capital £6,000 in £1 shares (4,000 8 per cent. cumulative preferred and 2,000 ordinary). Objects: To carry on the business of manufacturers of and dealers in electrical and other lamps, quartz lamps, reflectors, bells, cookers, etc. The subscribers are: L. I. Robinson, 3, Staple Inn, Holborn, W.C.1, and W. L. Pengelly, 2, South Square, W.C.1. Registered office: 3, Staple Inn, Holborn, W.C.1.

Returns of Electrical Companies

Mickelwright, Ltd.—Satisfaction to the extent of £100 on December 12th, 1931, and to the extent of £400 on March 16th, 1932, of debentures authorised December 7th, 1926, and registered December 9th, 1926. (According to the register of mortgages, the debentures registered December 9th, 1926, originally secured £1,500.)

Runbaken Motor and Electrical Accessories, Ltd.—J. W. Shepherd, 78, King Street, Manchester, ceased to act as receiver on April 27th.

Gorford Bros., Ltd.—W. A. Bridge, 3-5, Oxford Street, W.1, was appointed receiver and manager on May 13th, under powers contained in debenture dated October 16th, 1930.

Davey, Paxman & Co., Ltd.—A letter on the file dated May 25th, 1932, states that an Order of the Court has been obtained, whereby the appointment of H. F. Kemp as manager has been extended to September 26th, 1932. There is no alteration as regards his appointment as receiver.

Rye Electrical, Ltd.—Capital, £25,000 in 20,000 cumulative participating preference shares of £1 and 100,000 ordinary shares of 1s. each. Return dated December 21st, 1931. 12,502 preference and 92,500 ordinary shares taken up. £17,127 paid. Mortgages and charges, nil.

Siemens-Schuckert (Great Britain), Ltd.—Capital, £10,000 in £1 shares. Return dated January 11th, 1932. 9,400 shares taken up. £9,400 paid. Mortgages and charges, nil.

R. Brightwell, Ltd.—Capital, £7,000 in £1 shares. Return dated January 10th, 1932. 6,132 shares taken up. £580 paid, £5,552 considered as paid. Mortgages and charges, nil.

Synchronous Telegraphs, Ltd.—Capital, £5,000 in £1 shares. Return dated December 11th, 1931. 3,000 shares taken up. £100 paid. £2,900 considered as paid. Mortgages and charges, nil.

A. E. White & Co., Ltd.—Capital, £2,000 in 500 preference and 1,450 ordinary shares of £1, and 1,000 employés' shares of 1s. each. Return dated January 12th, 1932. 452 ordinary shares taken up. £452 paid. Mortgages and charges, nil.

Woodstock Power Syndicate, Ltd.—Capital, £10,000 in £1 shares. Return dated January 13th, 1932. 3,510 shares taken up. £3,510 paid. Mortgages and charges: £2,300.

Schall & Son, Ltd.—Capital, £20,000 in 9,000 preference and 11,000 ordinary shares of £1 each. Return dated January 5th, 1932. 5,100 preference and 9,102 ordinary shares taken up. £602 paid on 102 ordinary and 500 preference shares. £13,600 considered as paid on 9,000 ordinary and 4,600 preference shares. Mortgages and charges: £12,000.

Naider Bros. & Thompson, Ltd.—Capital, £30,000 in 15,000 preference and 15,000 ordinary shares of £1 each. Return dated December 16th, 1931. 14,968 preference and 14,849 ordinary shares taken up. £13,881 paid on 12,000 preference and 1,831 ordinary shares. £15,936 considered as paid on the remainder. Mortgages and charges, nil.

Greater Felcourt Co., Ltd. (formerly Lincolnshire Power Co., Ltd.).—Capital, £10,000, in £1 shares. Return dated January 13th, 1932. All shares taken up. £2,505 5s. paid (being £1 per share on 7, and 5s. per share on 9,993 shares). Mortgages and charges, nil.

General Cable Manufacturing Co., Ltd.—Satisfaction to the extent of £962 10s. on April 15th, of a series of debentures authorised by resolution dated November 2nd, 1931, and registered November 16th, 1931. (According to the register of mortgages, the series of debentures registered November 16th, 1931, originally secured £38,150.)

British Thomson-Houston Co., Ltd.—Satisfaction has been notified (1) to the extent of £121,194, on May 10th, of a trust deed dated March 10th, 1902, securing £200,000 debenture stock, (2) to the extent of £12,000, on same date, of acknowledgment of indebtedness dated October 28th, 1903, creating a further £12,000 debenture stock, making with the £200,000 already created a total of £212,000, and being supplemental to the said trust deed, and (3) to the extent of £1,516,870, on same date of trust deed dated November 30th, 1921, securing £3,000,000 debenture stock.

City Notes

Callender's Cable & Construction Co., Ltd.—The accounts of this company were abstracted in our last issue, p. 792, and the annual meeting was held on Tuesday last, Sir J. Fortescue Flannery (chairman) presiding. In presenting the report and accounts, the chairman said their operations were of world-wide extent. Their cables literally extended from China to Peru. In the first named country they had been established in a leading position in electricity for many years, and had recently joined with other leading British manufacturers in a concerted enterprise, from which they hoped to receive considerable home employment in the not distant future. The business of the company covered a very wide area, and the restricted conditions of trade which had generally prevailed at home and abroad had affected the quantity of business which they had been able to secure. Nevertheless, they had succeeded in receiving a profit which enabled them to meet all their liabilities and maintain the dividend. The general flow of orders had been reasonably maintained. The demand had not been as high as they expected, as the developments which were anticipated to arise as a result of the Central Electricity Board's schemes had not been as great as they hoped. The slackening off which occurred for a time had, as far as they could discover, ceased, and there was now a gradually increasing interest in electrical facilities, with a consequent greater demand for wires and cables. There had been rather a dearth of large contracts during the year, but they had a fair share of what had been going. Dumfries County Council had placed with them a contract for the necessary transmission and distribution lines in connection with the scheme for the electrification of practically the whole county. They were busy on the South-West England 132-kV grid contract, and had already completed about 25 per cent. of the work. The business of the Anchor Cable Co. had been maintained, and they had more than held their own in the market. New machinery had been installed at the Erith works which would tend to increase production as well as to secure greater economy. A good deal of money had been spent in the equipment and organisation of their research laboratory at Shepherd's Bush in order to meet the necessities of the manufacture of cables of higher voltages. This was their jubilee year, and they could look back with satisfaction upon the progress which had been made and congratulate Sir Tom Callender, the managing director, who had been in charge of the company's destinies throughout the greater part of that period, upon the remarkable fruition of his hopes and ambitions. The increase of £200,000 in the renewals and contingencies account included the surplus from the sale of the Surbiton undertaking to the London & Home Counties J.E.A. and the acquisition of the South Wales Power Co., Ltd., by another company, their shares being purchased at a satisfactory surplus over what they stood in their books. Regarding the current year, it had begun in circumstances even more difficult than 1931, but they saw slight but definite signs of some revival in business.

Sir Tom Callender, in seconding the motion for the adoption of the report and accounts, said that the depression which had existed had left its mark in their balance sheet. Not only had the amount of business been smaller, but the prices had been lower, chiefly by reason of the reduction in the standard prices prevailing for the leading articles used in their business. Home business was once again advancing, and the upward trend of orders was apparent during the last few weeks especially. Their weekly return sheet showed a large number of relatively small orders from all parts of the country, and indicated definitely that the industry was again stepping forward. Abroad, the position was not satisfactory. The factories in Germany, Holland, and Belgium were almost at a standstill, and prices had been current which could not but result in a loss. A quantity of their cable had been used in Athens, and the developments in Palestine had resulted in their obtaining a considerable number of orders for cables in that country. They had secured an order for the supply and laying of underground and overhead mains in Mosul, Mesopotamia, and in the Sudan another contract had been undertaken at Wad Medani. In India they had been engaged on the Government hydro-electric scheme in the Punjab. The main line was nearly completed, but they would be engaged all through the current year in the subsidiary mains supplying various towns in the district. Other contracts had been carried out in that country. They had decided, in spite of the war and the troubles in Shanghai, to maintain their office there, so as to keep in touch with their friends and be ready for the better business which they anticipated would result when normal conditions prevailed. They had succeeded

in getting some orders in Australia and so maintained their connection, while in New Zealand, although the business obtained was small, they had received their share. In South Africa the conditions had on the whole been better than in most of the other Dominions, and while orders had been smaller they had had their share of all that had been obtainable. In South America political and financial upheavals had practically brought enterprise to a standstill. The conditions in the United States, as reported by the Okonite-Callender Co., were equally unsatisfactory, but they were able to obtain a number of orders. With the introduction of the grid scheme it became evident that great alterations would be required with regard to the mains in connection therewith. They decided to enter into the super-tension business, but recognised they must consider themselves as pioneers and take risks and costs inseparable from pioneering work. Although some of the cables proved excellent, some thus laid gave trouble, which involved costly repairs or even replacement. The information from the existing research department at Erith was insufficient for this work, and they started the new research station at Shepherd's Bush, which was equipped with apparatus for testing at up to 150,000 V, and arrangements existed for doubling that pressure should it be necessary. They had proved conclusively the efficient working of 66,000-V cable, of which there would be large quantities used in the future.

Siemens Bros. & Co., Ltd.—The accounts of this company were abstracted in our last issue and the annual meeting was held on Friday last. Lord Queenborough (chairman), who presided, in presenting the report and accounts, said the amount due to the subsidiary company (£208,470), was £58,762 down on last year. This liability owed its existence to the financial difficulties of the Australian Commonwealth and they were unable to withdraw and bring to this country the large sum of money which they had on deposit with three of the principal banks there without incurring serious exchange losses. There had been a slight improvement in the rate of exchange during the year, and they were hopeful that in the course of time the money would be obtained without undue loss. The plant had been maintained at a high standard of efficiency by replacements and additions of machines of improved design. Materials and work in hand at £793,514 showed the substantial reduction of £174,190, which was accounted for by less work in the cable shops and the fall in the price of materials. They had succeeded in these critical times, not only in increasing their reserves, but in maintaining the dividend as well. Owing to the universal diminution in trade there was little demand for submarine telegraph cable, which in past years had been one of the prominent features of their business. Competition remained severe and had resulted in prices being reduced to an unremunerative level. Little could be looked for in this direction until the necessity arose for the establishment of long-distance telephone communication by cable. With regard to the lead-covered types of submarine telephone cable, during the year, in collaboration with the engineers of the Post Office, they had developed an entirely new type of loaded cable which possessed great economic advantages. They had been entrusted by the Government with the supply and laying of a cable between England and Belgium. It would allow four times as many conversations to be carried on simultaneously as was possible with any cable laid between this country and the Continent and would be completed and laid by the *Faraday* this summer. The demand for underground telephone cables by the Post Office had suffered considerable curtailment, and in consequence their manufacturing facilities were working much below capacity. An important network of cable, however, was made and laid by them in the North-West of England, and was completely furnished with the necessary loading coils. In recent months, however, the Post Office had placed a number of cable contracts which were now keeping the plant well occupied. The requirements for underground power mains fell much below the average of a number of years past, but they secured a fair share of the available business. Copper and rubber had fallen in value to the lowest points ever recorded, and the prices of other constituents of cable, such as lead and tin, were also much below the rates ruling for a number of years past. There was practically an entire absence of contracts of importance from the Overseas Dominions. The demand for cable accessories, such as joint and service boxes, &c., was steadily advancing. They had a steady demand for telephone exchange equipments, both for the home and overseas markets. Among the contracts placed by the British Post Office were exchanges for Tulse Hill, Brentwood, Orpington, Uxbridge, and the Whitehall automatic telephone exchange, while in the provinces contracts were received for twenty-three exchanges, besides extensions to other exchanges and a considerable number of rural automatic exchanges. Exchange equipment had also been supplied to the Southern Railway for Southampton Docks and Waterloo, and to the Admiralty for the Royal Naval Hospital at Devonport dockyard. Among other orders was one for 200,000 "Neophones" for the public telephone service of the country. Contracts for exchanges and extensions abroad included equipment for the Cape Town area, Port Elizabeth and Pietermaritzburg, Elmwood, St. John's and Winnipeg West (Canada), Umtali (S. Rhodesia), Mysore and Bangalore, and the island of Malta, while substantial quantities of telephone apparatus were also shipped to Australia, S. America, Egypt, F.M.S., Gold Coast, &c. Their private automatic exchange business was developing satisfactorily and they had supplied equipments to a large number of public institutions, business houses, factories, &c. Automatic telephone apparatus for the remote control of power stations had been standardised by them after considerable development and research work, of which they were now beginning to reap the fruits. Totalisator equipment had been supplied to several greyhound tracks. The number of cells and batteries of all types manufactured was greater than in any previous year, but to meet competition selling prices of all classes, particularly of wireless types, had to be greatly reduced. Their business in ships' electric telegraphs had been well maintained, and most of the important vessels completed during the year had been fitted with their apparatus. The "Ford" electrical torsionmeter had been adopted by the American and French navies, and was now in use in the British, Italian, and Spanish navies. Despite adverse conditions in the shipping industry, their turnover in marine wireless telegraph business showed only a small reduction. They were now making at their works at Woolwich an all-British electricity meter for which they were receiving an increasing number of orders. Important contracts for overhead transmission lines had been carried out in East England for the Central Electricity Board and in the Northern Delta for the Egyptian Government. These were not yet completed, and orders for extensions had been received in connection with the Delta contract. There had been a great falling off in business in all overseas territories, except in S. Africa, where sales had been fairly well maintained. They had not incurred during the past year any trading losses due to exchange depreciation or restrictions. Siemens Electric Lamps & Supplies, Ltd., again showed satisfactory results, and they had recently transferred the sale of high-tension radio batteries to that subsidiary company. Regarding the future, orders in hand would enable them to keep in regular employment more workpeople than a year ago, a condition which would last for a good many months to come. The order sheet for the four months of the current year, however, showed a falling-off as compared with last year, but having regard to the fact that large orders, such as they received from time to time, were placed at regular intervals, the period of four months was too short to give a general picture of what the position was likely to be during the whole year.

The Chloride Electrical Storage Co., Ltd., held its annual meeting on May 27th, Mr. W. S. Naylor (chairman) presiding. In presenting the report and accounts (ELECTRICAL REVIEW, May 20th, p. 757), the chairman said that the reduction in profit was to some extent due to expenses incurred in the reorganisation of subsidiaries and the development of new lines of business. Although a larger dividend might have been paid, they were consulting the best interests of the company in conserving their resources. The reserve might be said to be invested in gilt-edged securities. Most of the item £210,992 represented their interests in Australia, including a well-equipped factory. The buildings and equipment of their works here and their depôts had been maintained in an efficient condition and new plant had been installed where necessary. The general health of their employés continued to improve as a result of the constant attention of their medical officer. Their export business had been adversely affected by the low prices of primary products, the restrictions on foreign exchange transactions, and by tariffs. Their turnover at home exceeded that of the previous year. They could claim that it was standard practice to install their "Keepalite" system of emergency lighting in hospitals, and the system was also extensively adopted in cinemas, public halls, banks, and large stores. A "Keepalite" equipment had been ordered for the Disarmament Conference Hall at Geneva. The "Exide" battery for wireless had more than held its place with the public, and their sales in this direction showed an increase over the preceding year. It was thought by many people that the battery radio set was rapidly being ousted by the "all-mains" set. A careful investigation of the facts proved this assumption to be inaccurate. The "Drydex" battery, which was new on the market twelve months ago, had established itself in the public favour. Prices had been reduced and sales were steadily mounting up.

Richard Johnson & Nephew, Ltd.—The accounts of this company were abstracted in our issue of May 20th, p. 757, and the annual meeting was held on May 27th. Lt.-Gen. Sir Walter Campbell, who presided, in the course of his speech said that in his address last year he referred to the 60,000 tons of wire imported into this country. If anything, this phase of dumping was accentuated during the last three months of 1931. The existing provisional tariff was far from satisfactory: under its provisions the raw material of the wire-drawer, namely, rods, had a 33⅓ per cent. protection, whereas the finished article, wire, was only protected to the extent of 20 per cent. The non-ferrous side of their business had been disappointing. He could only imagine that the holding up of the larger schemes of development which must use this metal was due to a false wave of economy. During the year they had completed various contracts for steel-cored aluminium conductor in connection with the Central Electricity Board schemes. The improvement in the year's trading enabled them to pay an ordinary dividend of 7 per cent. (against 5 per cent). It had been a difficult year, and such orders as were obtained were the result of the constant endeavour to reduce costs of expenditure to the lowest figure compatible with high standard of quality. The works at Ambergate were flooded last autumn, but they were out of action only a few days. The material damage, however, was considerable. Mr. J. T. Johnson had retired as joint managing director, but remained on the board. Mr. J. G. Crozier, director and secretary, had been appointed joint managing director, and Mr. G. T. Haigh had been appointed secretary.

The Shanghai Electric Construction Co., Ltd., held its annual meeting on May 25th, Mr. J. S. Haskell (chairman) presiding. In presenting the report and accounts (ELEC. REV., May 20th, p. 757), the chairman said the accounts covered a period before the troubles which in recent months had occasioned so much anxiety in regard to Shanghai came to a head. Although the year was free from international complications, the early part of it was disturbed by a strike which fortunately was of short duration and did not at any time lead to a complete cessation of operations. The strike occurred within a few days of a general revision of their tariff, the effect of which was for a time necessarily obscured, but, when operating conditions became normal again, traffic receipts exhibited a satisfactory tendency. During the greater part of the year the course of silver exchange was unfavourable and remittances were received at a rate of less than one shilling to the dollar. There was an improvement in this respect in the later months, and the rate of 1s. at which profits had been brought into account was somewhat less than the average rate at which remittances were made, with the result that the profit and loss account showed an appreciable credit under the heading of exchange. The local current assets and liabilities had been converted into sterling at 1s. 4d. to the dollar, but that rate had scarcely been maintained during the current year. The operating profit showed an increase of 37.91 per cent., and the profits of the

year would have permitted of a somewhat larger dividend (12½ per cent.), but they had not overlooked the fact that the current year's earnings had been seriously reduced by hostilities on the borders of the International Settlement. The second general renewal of the tramway track would have to be taken in hand at no distant date, and there were certain extensions in contemplation. It might, therefore, be advisable in the near future to raise funds by an issue of shares on terms favourable to shareholders. There had for some time been a movement on foot in Shanghai to transfer the control of the company to that city, having regard to the large portion of the share capital which was held there. Operating conditions were returning by degrees towards normality, but although they were running full services, traffic receipts had not yet fully recovered.

The Brush Electrical Engineering Co., Ltd., in its report for the year ended December 31st last, states that the sum of £23,114 has been written off for depreciation of buildings and plant, this being about £7,000 in excess of the provision made in the preceding year. During recent years a somewhat low rate of depreciation has been adopted in view of the considerable excess of the actual value of the property as compared with the book value. The directors are advised that a higher rate is desirable, although the valuation of the property is on a conservative basis. The sum of £15,896 has been spent on capital account during the year. The gross profit on trading is £15,251, but after providing for general charges, maintenance of plant and buildings, debenture interest and depreciation, there is a deficit of £41,631, which is deducted from general reserve. This now stands at £220,446. Cash on deposit and in hand is increased to £79,299, while the present value of the investments in Government securities is in excess of the £98,832 shown in the balance-sheet as the actual cost. Meeting: June 6th.

The Ever Ready Co. (Great Britain), Ltd., held its annual meeting on May 31st, when Mr. Magnus Goodfellow (chairman), who presided, said that the sales during the year showed an advance in value of nearly 30 per cent., as compared with the preceding year, and, expressed in units of production, the advance was greater still, as prices were reduced on July 1st, 1931. There had again been an increase in consumption of all primary batteries in this country during the year, which he estimated at between 15 and 20 per cent. The depreciation in value of the £, followed by the imposition of a 20 per cent. *ad valorem* duty on the importation of primary batteries, resulted in the practical stoppage of imports by the end of the year 1931; in fact, since January last, such imports had shown a decrease of 90 per cent., and their early preparatory work had enabled them to obtain the greater part of this business. They had purchased two new factories which would be capable of coping with the increased business they hoped to obtain next autumn. Their trade investments included £200,000 in Lissen, Ltd., which for the past year showed a net profit of £94,000. The investment in the Ever Ready Trust Co., Ltd., was unchanged. They received no income on this investment during the year, but hoped to receive their first dividend this year. There had been a substantial increase in sales during April and May of the current year.

La Plata Electric Tramways Co. reports net receipts of £24,621 for 1931, as compared with £23,495 for 1930, and after deducting debenture interest, &c., and loss on exchange, there is a profit of £10,172 (£8,455), to which is added £18,385 brought in making £28,557. Renewals reserve receives £12,947 and £15,610 is carried forward. During the year claims for outstanding paying accounts, which had not previously been admitted by the company, were settled for a reduced sum of $330,000 (paper), payable as to $100,000 in cash and the balance by six half-yearly instalments. The report states that every effort is being made to obtain the long-delayed ratification by the Provincial Government of the company's concession. The directors are unable to report the amicable rescission of the agreement for the sale of the company's undertaking to La Nacional Tramways Co. in accordance with the wishes of the shareholders. In existing circumstances it will be necessary to retain all surplus funds derived from earnings to provide for payment of the claims referred to and for the balance of capital expenditure to be made under the terms of the concession. Meeting: To-day (Friday).

Light Controlled Installations, Ltd., which was registered on January 30th last, held its statutory meeting on May 26th, Mr. W. Blount presiding. In the course of his speech Mr. Blount said that their automatic light control bridge was not only a commercially and scientifically satisfactory piece of apparatus, but it could be made rapidly and in large quantities at a commercial price. A sales organisation had been established and the whole of the London area was now covered, and, in addition, the counties of Buckinghamshire, Berks, and Kent, the whole of the South Coast, and the cities of Leeds and Manchester and their environs. Many important contracts had been entered into and the capital resources were adequate for their immediate requirements.

The Canadian Bell Telephone Co. announces that the basis of the next quarterly payment for dividend will be at the rate of an annual dividend of $7 instead of $8. This is the first time for forty-one years that the dividend rate has been reduced. The reduction in dividend is due to increases in taxation and the falling off in net earnings, particularly on account of long distance calls. A further reduction in wages schedules is also announced.—*Reuter* (Montreal).

The North American Light & Power Co. reports gross earnings for the year ended March 31st last of $45,634,192, as compared with $47,054,505 in the preceding year, and net earnings, before providing for depreciation reserves, of $21,125,390 ($21,725,351). Appropriations for depreciation reserves totalled $3,301,188, and the consolidated earnings, after all preferred dividends, amounted to $2,362,073 ($4,235,741), equal to $1.50 per share of common stock (against $2.82). The output of electricity of subsidiaries was 1,021,700,000 kWh, as compared with 1,044,400,000 kWh.

Turner & Newall, Ltd., have declared an interim dividend on the ordinary stock of 1¼ per cent., actual, less tax, as against 2½ per cent. a year ago. The directors state that the available profit for the half-year is sufficient to pay the preference dividends and to maintain last year's interim ordinary dividend, but in recommending the reduced rate they have been influenced by the fact that world conditions show no sign of early improvement, and it is therefore specially desirable to conserve the resources of the company.

The Electric Construction Co., Ltd., reports that after providing for debenture interest and depreciation, there was a net loss for the year ended March 31st last of £14,634. A sum of £20,402 has been transferred from general reserve and added to £5,549 brought in. After deducting the net loss, it is proposed to pay the preference dividend and to carry forward £6,924. The report states that there was a further contraction in turnover during the year, with a consequent loss in trading. Since the close of the financial year, however, an increased demand has arisen, which, if maintained, will tend to restore the company's prosperity. The general reserve now stands at £150,000. Meeting, June 8th.

The Bergmann Electricity Company.—The acounts for 1931 of the Bergmann Elektrizitäts Werke, A.G. of Berlin, in which the A.E.G. and the Siemens group are largely interested, show a loss of 18.8 million marks after the writing off of 21.5 millions for depreciation; there was a loss of one million marks in 1930. The concerns in which the company is interested, including subsidiaries in London, Stockholm, Danzig, Kattowitz and Vienna, also yielded very unsatisfactory results last yeaf, and the foreign selling companies are being liquidated.

The Worcester Electric Traction Co. reports a revenue for 1931 of £4,663. An ordinary dividend of 4½ per cent. is proposed, leaving £1,814 to be carried forward.

The Cià. Hispano-Americana de Electricidad has decided to distribute a final dividend for 1931 at the rate of gold ptas. 30 for shares series "A," "B," and "C," and gold ptas. 6 for shares "D" and "E," free of Spanish taxes.

Crompton Parkinson, Ltd., announce a half-year's dividend to March 31st at the rate of 4 per cent. on the 8 per cent. first preference shares, 3 per cent. on the 6 per cent. second preference shares, and an interim dividend at the rate of 10 per cent. actual on the ordinary shares and the "A" ordinary shares.

Companies to be Struck Off the Register.—The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Bishops Castle Electric Light & Power Co., Ltd.
British Power, Traction & Lighting Co., Ltd.
Electrical Contracts & Maintenance Co., Ltd.

Stocks and Shares

TUESDAY EVENING.

THE chief financial interest, after the Derby, of the present week, centred upon the dividend payment to stockholders of the five per cent. War Loan. Attention had been keyed up to a high pitch by the possibility of some official announcement being issued with the dividend warrants, in regard to the long-expected conversion scheme, whose advent has already exercised so considerable an effect upon the prices of gilt-edged securities. The balance of City opinion was in favour of nothing happening, so far as an immediate conversion scheme is concerned. The forthcoming Conference at Lausanne, and the subsequent Conference at Ottawa, cannot fail to provide matters of such moment that both meetings are awaited with anxiety not unmixed with apprehension. The War Loan conversion doubts will be resolved before this issue of the paper appears.

Electricity Board's Stocks

In an atmosphere so fraught with uncertainties, it is natural that Stock Exchange markets should be nervous and disposed to depression. Business in new issues continues to provide a fair amount of activity. The stocks and shares connected with the electrical industry are holding their prices better than many others. For instance, amongst home electricity companies, prices are generally steady. City of London ordinary have improved to 38s. 3d., a rise of 9d.; County of London ordinary eased off to 42s. Of the debenture stocks, Central Electricity 4½ per cent. holds its ground at 97½, in spite of the wave of reaction which has swept over gilt-edged stocks as a whole. London and Home Counties 4½ per cent. debenture is 10s. better at 98. The Central Electricity stock will go ex dividend on the Thursday in this week, in respect of the July 1st payment. The London and Home Counties debenture interest is due a month later.

Edmundson's new issue of £1,250,000 6 per cent. cumulative preference shares was promptly subscribed, the lists closing within a couple of hours after their opening, when it was stated that the shares had been written for two or three times over. The market opened at a small premium, and the price settled down to the "par" figure of 21s. County of London new ordinary are 6d. lower at 1s. 9d. premium, and Scottish Power new preference have come on offer at 6d. premium.

Cables and Wireless

Prices of the three issues of Cables and Wireless stocks have fallen to the lowest levels reached since the combine was formed. It now takes little more than £50 to buy £100 of each class of stock. The 5½ per cent. preference is three points lower at 35½, and falls have occurred in each of the ordinary stocks. The company's year ends with December, and the accounts should be out before the close of June. The last dividend paid on the preference stock was in March, 1931, so there are now two half-years' dividends to be met. The stock is cumulative as to dividend. In the market, the prospects

of a payment on the preference stock next September are regarded as none too promising, though there are some who look for a partial distribution in respect of 1931.

On the weakness of Cables and Wireless, Globe Telegraph and Trust ordinary are down 10s., the preference 5s., to 3½ and 6¼ respectively. Great Northerns are unchanged at 22, on the issue of the annual report which shows the net profits to be about £23,000 down on the year. The dividend is maintained at 20 per cent., but the carry-forward is reduced. The directors mention the radio competition, and the troubles in China, as two of the principal items which have lately affected the company's receipts. Marconi Marines have further receded to 22s. 6d. American Telephone and Telegraph is unchanged at 130, but International Telephone and Telegraphs have given way to 4¼, being 1¼ down. Western Union Telegraph common stock at 25 is down by five points.

Home Railway Market

Metropolitan consolidated stock has further receded to 41½ on a little profit-taking. The protracted delay which has occurred in connection with the London Passenger Transport Bill is causing disappointment, and at the same time arousing protests against the amount of money which is being spent by the various interests concerned, during the time in which the Bill is before Parliament. Districts and Undergrounds remain at 51½ and 17s. respectively, and no changes have occurred in the Central London group. Of the debenture stocks, District 5 per cent. 1933-1943 is quoted at 101½, and the new 5 per cent. debenture, 1985-1995, at 105. Metropolitan 5 per cent. debenture, 1957-1962, is 104½. In both cases, partly paid scrip is available, that of the Metropolitan being 45 per cent. paid, and standing at 7 premium, while the District debenture, which came out at 97½, is 40 per cent. paid, and is quoted at 47½. The last issue of the District debenture was placed at 101½, and is now £44 paid, the price being the same as that of the stock just mentioned.

Manufacturing and Equipment

General Electric ordinary have receded to 33s. 9d., a fall of ¼, in sympathy with the dullness prevailing in many industrial sections. Ever-Ready shares gave way to 19s. 6d., showing a fall of 1s. 9d., and the premium on the new shares eased off to 8s. Siemens hold their recovery to 21s. 3d., the meeting being regarded as satisfactory. Brush Electrical Engineering ordinary stock receives no dividend. The price of the stock is quoted nominally at 55. The Electric Construction Company reports a loss for the year ended March 31st last of £14,633. By transference of £20,400 from general reserve fund, it is possible to pay the preference dividend of 7 per cent., and to carry forward £6,922. Crompton Parkinsons have declared dividends of 10 per cent. on the ordinary and the "A" ordinary shares, payable at the end of June. Last year the rate was 11¼ per cent. in each case, and for the whole year 30 per cent. was paid.

Falls in Callender's, British Insulated and Henley's reflect the uneasy sentiment that prevails in regard to trade. British Insulated preference, however, have strengthened to 25s.

Foreign and Overseas

The financial situation in the United States shows little indication of clearing. With an election pending in November, each party in the States is naturally anxious not to take steps that might lead to a loss of votes. As the main desideratum is that all parties shall pull together in an effort to place the country on a sound financial foundation, the immediate prospect, in view of the forthcoming election, hardly suggests the likelihood of unity.

Brazilian Tractions have given way to 10, and San Paulo 5 per cent. bonds to 60. The Mexican issues continue their downward course; Mexico Trams 5 per cent. bonds at 22½ show a further fall of 3, on the top of their last week's drop of 7 points. Mexican Light and Power preferred shares at 20 are 2½ down. Amongst the sterling bonds, Prussian Electric 6 per cents. have dropped 5 to 35, on the resignation of the German Government, and the crisis with which Germany is now faced. Tokyo sixes have fallen back to 60. Amongst the Indian issues, Tata 7½ per cent. "B" debentures have gained two points at 103. Madras Electric new ordinary, which were allotted at 25s., are 25s. 3d. The preference, issued at 22s., stand at 22s. 6d. Anglo-Argentine Tramways issues have not changed upon the arrival at Buenos Ayres of the company's chairman, the Duke of Atholl, who is to endeavour to compose the differences now existing between the company and the City.

Miscellaneous Matters

Babcock & Wilcox weakened to 37s., and the shares in the iron and steel group are mostly easier where movements have occurred. Vickers at 5s. 4½d. are down 6. No changes have taken place in the rubber position,

Electrical Securities and Finance 5½ per cent. debenture is 2 points better at 104. British Power new preference shed a few pence, going back to 1½d. discount, and the ordinary shares declined to 12s. The annual meeting of Philips Incandescent Lamp Works was held at Amsterdam on the Monday in this week. The ordinary shares are quoted at 13s. 9d. Holders of Vancouver Power 4½ per cent. debenture stock are to be given the chance of obtaining repayment at 107 in July this year, instead of waiting until 1953. They should accept payment only in dollars—not sterling—and thereby get the advantage of the present premium on gold.

Share List of Electrical Companies

Home Electricity Companies.

	Nom.	Approx. Dividend. 1930.	1931.	Price. May 31.	Rise or Fall.	Yield p.c. £ s. d.
Bournemouth and Poole	1	15	15	60/9	—	4 18 9
Brompton Ordinary	1	8½	8½	28/-	—	5 0 0
Central Electricity 4½% Deb.	Stock	4½	4½	97½	—	4 12 4
Charing Cross Ordinary	1	8½	8½	29/-	—	4 16 7
Chelsea	1	8½	8½	27/6	—	5 1 10
City of London	1	10	10	38/3	+9d.	5 4 7
Clyde Valley	1	8	7	27/6	—	5 1 10
County of London	1	11	10½	42/-	−6d.	5 0 0
Edmundsons' 7% Pref.	1	7	7	26/6	—	5 5 8
Elec. Dis. Yorkshire	1	9	9	35/-	—	5 2 10
Elec. Supply Corporation	1	11	—	47/6	—	4 12 7
Kensington Ordinary	1	8	8	28/6	—	4 18 3
Lancs. Light and Power	1	6½	7	26/3	—	5 6 8
London & Home Counties 4½% Deb.	Stock	4½	4½	98	+½	4 11 10
London Electric	1	9	9	28/-	—	5 0 0
Metropolitan	1	10	10	41/3	—	4 17 6
Midland Counties	1	7	7	28/9	—	4 17 5
Mid. Elec. Power	1	8	8	30/6	—	5 5 0
Newcastle-on-Tyne Ordinary	1	6	6	23/9	—	5 1 1
Do. 7% Pref.	1	7	7	27/6	—	5 1 10
Northampton	1	10	10	40/9	—	4 18 2
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	25/-	—	4 16 0
St. James' and Pall Mall	1	8	8	28/-	—	5 0 0
Scottish Power	1	8	—	28/3	—	5 13 3
South London	1	8½	8½	28/6	—	4 18 3
Urban Ordinary	1	7	—	28/9xd.	—	4 17 5
Westminster Ordinary	1	8½	8½	28/-	—	5 0 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	16/3	—	9 4 8
Yorkshire Elec.	1	8	8	33/9	—	4 14 10

Home Rails.

Central London Ord. Assented	Stock	4	4	72½	—	5 10 4
Metropolitan	„	4	3½	41½	−2	8 8 5
Do. District	„	5	4½	51½	—	8 14 10
Underground Electric	1	8	7	17/-	—	8 4 8

Telegraphs and Telephones.

		1929.	1930.			
American Tel. & Tel.	$100	9	9	130	—	6 18 6
Anglo-Am. Tel. Pref.	Stock	6	6	97	—	6 3 9
Do. Def.	„	1½	1½	22	—	6 16 6
Cables & Wireless 5½% Pref.	„	5½	5½	35½	−3	—
Do. A 7½% Ord.	„	Nil	—	10	−2	—
Do. B Ord.	„	Nil	—	6½	−1½	—
Globe Tel. and T. Ord.	10	10	8½	3½	-½	—
Do. do. Pref.	10	6	6	6½	−½	9 12 0
Great Northern Tel.	10	20	20	23	—	8 13 10
Marconi-Marine	1	15	15	22/6	−⅛	6 17 9
Oriental Telephone Ord.	1	12	12	2⅛xd.	—	*5 4 0

Home and Foreign Trams, etc.

Anglo-Arg. Trams First Pref.	5	5½	—	6/3	—	—
Do. do. 2nd Pref.	5	6	—	3/9	—	—
Do. do. 5% Deb.	Stock	5	5	8	—	—
British Electric Traction Def. Ord.	„	5	5	675	—	—
Do. do. Pref. Ord.	„	8	8	125½	—	6 7 6
Brazil Traction	100	8	—	10	−1	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	89½	−1	5 11 9
London & Sub. Trac. 5% Pref.	1	Nil	Nil	3/9	—	—
London United Tram Deb.	Stock	4	4	57½	—	6 19 2
Mexico Trams, 5% Bonds	—	5	5	22½	−3	22 4 4
Mexican Light Common	100	Nil	Nil	12½	—	—
Do. 7% Pref.	100	7	7	20	−2½	35 0 0
Do. 1st Bonds	—	5	5	52½	−2	9 10 6
Victoria Falls Ord.	1	15	15	57/6	—	5 4 4
Yorkshire (West Riding)	1	Nil	Nil	4/6	—	—

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	6	15/9	−6d.	5 1 7
Do. Pref.	1	8	8	28/3	—	5 13 3
Babcock & Wilcox	1	15	14	37/-	−1/9	7 11 4
British Aluminium Ord.	1	10	10	21/3	—	4 14 2
British Insulated Ord.	1	15	15	53/9	−½	5 11 6
Brush Ord.	Stock	10	5	55	—	9 1 8
Callender's	1	15	15	52/6	−⅛	5 14 3
Do. 6½% Pref.	1	6½	6½	25/9	—	5 1 0
Crompton Parkinson Ord.	5/-	30	30	17/6	—	8 11 6
Do. 8% Pref.	1	8	8	27/6	—	5 16 5
Edison-Swan 1st Pref.	1	7½	7½	23/3	—	6 9 0
Do. 5% Deb.	Stock	5	5	92½	—	5 8 1
Electric Construction	1	5	Nil	7/6	—	—
Enfield Cable Ord.	1	25	25	3⅛	—	7 8 2
English Electric	1	Nil	Nil	8/9	—	—
Do. do. Pref.	1	Nil	Nil	10/-	—	—
Ever Ready	5/-	35	35	19/6	−1/9	8 19 6
Ferranti Pref.	1	7	7	22/-	—	6 7 3
G.E.C. Pref.	1	6½	6½	26/-	—	5 0 0
Do. Ord.	1	14	10	33/9	−½	5 18 6
Henley's	1	30	30	4½	−⅛	6 3 0
Do. 4½ Pref.	5	4½	4½	4½	—	5 8 9
India-Rubber	1	Nil	Nil	4/6	—	—
Johnson & Phillips	1	10	10	¾xd.	—	5 14 3
Siemens Ord.	1	7½	7½	21/3	—	7 1 2
Telegraph Construction	12	10	7½	10	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1930

32527. "Electro-mechanical synchronous switches for measuring purposes, also adapted for use as rectifiers." Siemens & Halske Akt.-Ges. October 30th, 1929. (372305.)

35977. "Electric furnace." C. I. Hayes. November 29th, 1930. (372380.)

36438. "Electric circuit interrupters." Westinghouse Electric & Manufacturing Co. December 10th, 1929. (372284.)

1931

624. "Rectifying systems for electric currents." British Thomson-Houston Co., Ltd. January 9th, 1930. (372386.)

2336. "Insulated electric conductors and other insulated electrical apparatus." Standard Telephones & Cables, Ltd., T. R. Scott, and M. C. Field. January 23rd, 1931. (372312.)

2768. "Systems comprising light sensitive cells." F. H. Constable and Radiovisor Parent, Ltd. January 28th, 1931. (372288.)

2968. "Supports for mechanical or electrical sound recording or reproducing devices." F. H. M. Bennett. January 29th, 1931. (372317.)

3128. "Electric hair combs and the like." F. H. Norris. January 31st, 1931. (372333.)

3333. "Television apparatus or the like." Fernseh Akt.-Ges. February 5th, 1930. (372348.)

3436. "Electrical signalling systems." Automatic Electric Co., Ltd., T. R. Rayner, and T. H. Turney. February 3rd, 1931. (372294.)

3451. "Method for the asynchronous starting of synchronous and asynchronous machines supplying wattless current." Siemens-Schuckertwerke Akt.-Ges. February 21st, 1930. (372352.)

3466. "Method of and means for television." Electrical Research Products, Inc. February 3rd, 1930. (372299.)

3476. "Electric battery lamps." Dura Co. November 3, 1930. (372300.)

3503. "Photo-electric cells." Telefunken Ges. für Drahtlose Telegraphie. February 19th, 1930. (Addition to 358539.) (372392.)

3595. "Thermionic valves." P. Freedman. February 4th, 1931. (372393.)

3710. "Electromagnetically operated electric circuit closing and opening devices." Siemens Bros. & Co., Ltd., and E. A. Bryan. February 5th, 1931. (372357.)

3868. "Television and like apparatus." Marconi's Wireless Telegraph Co., Ltd., and H. M. Dowsett. February 6th, 1931. (372370.)

3886. "Terminal boards for electricity meters." Allgemeine Elektricitäts Ges. February 8th, 1930. (372371.)

3949. "Telephone instrument circuits." Siemens Bros. & Co., Ltd., and E. R. Wigan. February 7th, 1931. (372400.)

4047. "Electrical measuring or relay apparatus particularly for high potential circuits." British Thomson-Houston Co., Ltd.. J. G. Wellings, and C. G. Mayo. February 9th, 1931. (372404.)

4460. "Electrical modulation arrangements suitable for use in radio and other high frequency signalling systems." Marconi's Wireless Telegraph Co., Ltd., and W. T. Ditcham. February 12th, 1931. (372414.)

4463. "Picture telegraph television and like systems." Telefunken Ges. für Drahtlose Telegraphie. February 12th, 1930. (Addition to 1913/31.) (372415.)

4522. Moving-coil loudspeakers." J. A. Guthrie. February 13th, 1931. (372417.)

4925. "Variable electric resistances." Steatit-Magnesia Akt.-Ges. March 24th, 1930. (372433.)

4995. "Device for the periodic opening or closing of an electric circuit." Siemens Bros. & Co., Ltd., and H. E. Humphries. February 17th, 1931. (Addition to 334516.) (372435.)

5713. "Brush-gear for dynamo-electric machines." C. A. Wood. February 24th, 1931. (372443.)

5858. "Electric switches for use with electric systems of motor vehicles." R. Bosch Akt.-Ges. February 26th, 1930. (372447.)

5928. "Electrolytic cells." A. Mentzel. February 25th, 1931. (372451.)

6083. "Mercury-vapour rectifiers." Akt.-Ges. Brown, Boveri et Cie. February 27th, 1930. (372454.)

7613. "Automatic electric switching apparatus." Landis & Gyr. Soc. Anon. March 13th, 1930. (372469.)

7682. "Electric fires and radiators." H. H. Berry and C. A. Painton. March 12th, 1931. (372471.)

7902. "Electromagnetic valves." J. L. Musgrave and R. Crittall & Co., Ltd. March 14th, 1931. (372479.)

9064. "Mechanism for arc regulation." R. Sarazin. March 24th, 1930. (372494.)

9332. "Electric water-heaters." A. Low & Sons, Ltd., and D. W. Low. March 27th, 1931. (372497.)

9438. "Thermionic valve circuit arrangements." Etablissements E. Belin. March 29th, 1930. (372498.)

9446. "Electric fans." Veritys, Ltd., and H. W. Smallwood. March 28th, 1931. (372499.)

11138. "Electro-optic control system." Communication Patents, Inc. July 24th, 1930. (372521.)

11180. "Apparatus for the directional transmission or reception of submarine sound-waves." Electro-acustic Ges. June 23rd. 1930. (Addition to 304124.) (372522.)

11339. "Electric discharge tubes provided with a metal sleeve." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 16th, 1930. (372526.)

11389. "Telephone systems." W. T. J. Donovan and G. L. Wolley. April 17th, 1931. (372527.)

11475. "Fusible cut-outs for electric circuits." Callender's Cable & Construction Co., Ltd., and A. W. Metcalf. April 17th. 1931. (372528.)

11560. "Operating and controlling mechanism for electric circuit breakers." British Thomson-Houston Co., Ltd. April 18th. 1930. (372529.)

11700. "Sound reproducing apparatus." Marconi's Wireless Telegraph Co., Ltd. April 18th, 1930. (372533.)

12115. "Electric imitation fires." H. H. Berry. April 23rd, 1931. (Addition to 323190.) (372540.)

12424. "Adjusting devices for X-ray tubes." Dr. R. Mannl. April 28th, 1930. (372542.)

12514. "Protective apparatus for electric circuits." British Thomson-Houston Co., Ltd. April 28th, 1930. (372547.)

12627. "Electrode holders for use in electric arc welding." Quasi-Arc Co., Ltd., and A. E. Villiers. April 29th, 1931. (372549.)

12903. "Electric arc lamps." R. V. Boardman. May 1st, 1931. (372552.)

13314. "Voltmeter to measure and verify the condition of charge of accumulator batteries for automobiles or other purposes." L. Mellersh-Jackson (Ateliers Ad & Dutilh). May 5th, 1931. (Convention date not granted.) (372554.)

13725. "Devices incorporating fuses for connecting electric mains to wireless sets, battery eliminators, and the like." Belling & Lee, Ltd., and E. M. Lee. May 8th, 1931. (372557.)

15495. "Electric insulators." W. W. Triggs (Ohio Brass Co.). May 27th, 1931. (372571.)

16001. "Electric hot plates." Hermsdorf-Schomberg Isolatoren Ges. May 30th, 1930. (372577.)

16907. "Commutators for electric motors." S. J. Watson. June 10th, 1931. (372587.)

17324. "Electrostatic loud speakers." H. Vogt. June 17th, 1930. (372590.)

18077. "Radio receivers." Ideal Werke Akt.-Ges. für Drahtlose Telephonie. June 24th, 1930. (372604.)

18715. "Electrical insulators." W. G. Thompson. June 29th, 1931. (372608.)

22096. "Electric switch for use with vehicle direction indicators or the like." A. Schwarz. August 2nd, 1930. (372634.)

24576. "Electric control systems employing thermionic valves and other electron discharge devices." Marconi's Wireless Telegraph Co., Ltd. September 8th, 1930. (372654.)

25065. "Devices comprising a gasfilled electric discharge tube." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 11th, 1930. (372657.)

25564. "Thermionic amplifiers." Marconi's Wireless Telegraph Co., Ltd. September 17th, 1930. (372660.)

25955. "Electric water-heaters." W. E. Barron. September 16th, 1931. (Addition to 20519/30.) (372665.)

25991. "Machine set or group comprising a prime mover and an electric generator." Siemens & Halske Akt.-Ges. October 3rd, 1930. (Addition to 355009.) (372666.)

26046. "Electric switches with fusible retaining means." A. Appel and B. Appel (trading as firm of Leopolder & Sohn). September 19th, 1930. (372667.)

26111. "Wireless apparatus." R. Brandt. January 8th. 1931. (372668.)

27012. "Aircraft appliances for lighting the ground and providing a beacon." Holophane, Ltd. (Soc. Anon Francaise Holophane). September 28th, 1931. (372215.)

27726. "Mercury-vapour rectifiers." Akt.-Ges. Brown Boveri et Cie. October 11th, 1930. (372222.)

28515. "Electric lighting systems for vehicles driven by internal-combustion engines." Sulzer Frères Soc. Anon. November 17th, 1930. (372684.)

29055. "Oscillation generators, remote control systems and superheterodyne receivers." Marconi's Wireless Telegraph Co., Ltd. October 18th, 1930. (372687.)

30030. "Pressure equalising reservoirs for electric cable installations employing cables impregnated with oil or other compound." Siemens-Schuckertwerke Akt.-Ges. November 1st, 1930. (372691.)

30120. "Heterodyne receivers suitable for use for wireless and other high-frequency reception." Marconi's Wireless Telegraph Co., Ltd. October 30th, 1930. (372692.)

31059. "Electric roll type condensers." Siemens-Schuckertwerke Akt.-Ges. December 1st, 1930. (372695.)

31396. "Sparking plugs for internal combustion engines." B. Pregel. November 12th, 1930. (372237.)

32967. "Control of multi-phase electric motors associated with condensers." International General Electric Co., Inc. November 27th, 1930. (372701.)

33433. "Electric signalling systems." W. Kidde & Co., Inc. November 21st, 1929. (Divided application on 33233/30.) (372248.)

33434. "Automatic electric signalling systems." W. Kidde & Co., Inc. November 21st, 1929. (Divided application on 33233/30.) (372249.)

1932

1917. "Device and method for forming electric resistances." E. Challet. March 10th, 1930. (Divided application on 7069/31.) (372714.)

3476. "Granulated carbon microphones." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 23rd, 1931. (372716.)

9267. "Sparking plugs for internal-combustion engines." AC Sphinx Sparking Plug Co., Ltd., and D. H. Corbin. April 13th, 1931. (Divided application on 10875/31.) (372724.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 25th.

Dajen. No. 529,368. Class 13. Electrical fusible cut-outs of ordinary metal.—The Electro-Thermic Development Co., Ltd., St. Stephen's House, Westminster, S.W.1.

Panelux. No. 530,402. Class 13. Lamps (ordinary), and lamp shades and reflectors made of ordinary metal. No. 530,403. Class 15. Lamp shades and reflectors, all made principally of glass.—Nico Light Co., Ltd., 19-21, Farringdon Avenue, E.C.4.

Thermotainer. No. 516,671. Class 18. Electrically heated chambers in the nature of ovens for storing cooked foods at a pre-determined temperature.—The Waters-Genter Co., 213, North 2nd Street, Minneapolis, Min., U.S.A. (British representatives: Frank B. Dehn & Co., 103, Kingsway, W.C.2.)

Cellomold. No. 530,621. Class 50. Moulding powders made of cellulose ethers or esters or of synthetic resin.—Cellomold, Ltd., 104-106, Great Portland Street, W.1.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Barking.—Houses (20), Ripple Road; Lord & Mellodew.

Barnstaple (DEVON).—Houses (30); borough surveyor.

Barwell (LEICS).—Premises, High Street; Architects' Department, Co-operative Wholesale Society, Ltd., Balloon Street, Manchester.

Bexhill-on-Sea.—Hotel, Cooden, for Earl De La Warr; E. Bunce, architect, Power house, Normans Bay, for W. E. Mullins; J. C. Smith, architect.

Biggar.—Houses (20), North Back Road; Cullen, Lockhead and Brown, architects, Hamilton.

Bolton.—Houses (420) and shops, Johnson Fold Estate; borough engineer. Houses (27), Burnham Avenue; A. T. Reynolds & Co.

Bournemouth.—Alterations and additions, Southbourne Girls' High School, Beaufort Road; Miss G. Greaves. New department, Stourfield School; borough engineer.

Brentford.—Factory for Coty's, Gt. West Road; Wallis, Gilbert & Partners, architects.

Brighton.—Central heating, mental institution (£28,000); A. H. Barker, consulting engineer. Houses (40); borough engineer. Reconstruction of Lloyds Bank, Western Road.

Bursiem (STAFFS).—Alterations and additions to premises, Moorland Road; Mutual Assurance Collecting Society. Houses (116), Bycars Estate; Sambrook Bros.

Cadzow (LANARKSHIRE).—R.C. Church, Hall Street (£2,020); L. B. White, builder, Bellshill.

Carlisle.—Theatre at the Cumberland Infirmary; J. S. Howitt, secretary.

Cheltenham.—Highbury Congregational Church (£10,000); N. T. Myers, architect. Cinema, with electrical work; McLaughlin & Harvey, Ltd., builders, 24, Highbury Grove, London.

Chesterfield.—Extensions, technical college, for the E.C. (£10,432); Evans Bros., Riddings.

Chester-le-Street.—Houses (206); U.D.C. surveyor, Council Offices.

Dartford.—Greaseproof paper mill for Wiggins, Teape & Co. (1919), Ltd.

Dewsbury.—School (260 places); Holtom & Fox, architects, Union Street.

Dumfries.—Reconstruction of labour exchange, Irish Street; H.M. Office of Works, King Charles Street, S.W.1.

Durham.—School (200 places), Burnhope Colliery, for the C.C.; F. Willey, architect, 34, Old Elvet, Durham.

Ealing.—Flats, Hamilton Road; Bagley Estate, Ltd., Heath Road, Twickenham. Flats and garages, Park Hill and King's Road; W. H. Read & Co., Ltd., architects, 42, Haven Gardens, W.5. Extensions to St. Joseph's Catholic School; Pipe and Hunt, architects, 37, George Street, Portman Square, W.1.

East Lothian.—Houses (116), with electric lighting; county architect, Property and Works Dept., Haddington.

Eccles.—Handicraft and domestic instruction accommodation for the E.C. Houses (105), Peel Green and Southern Estates; borough engineer.

Edgware.—Extensions to Redhill Institution (£134,125); Middlesex county architect.

Edinburgh.—Reconstruction of Nicholson Street Church (£10,000); J. R. McKay, architect, 4, Melville Street. Houses (34), for the Bangholm Building Co.; G. Bain.

Essex.—Combined treatment centre, Hornchurch; nurses' home, Epping Institution; and institution, Thremhall Priory Estate, Takeley, for the C.C.; J. Stuart, county architect, Chelmsford.

Falkirk.—Houses (128), Millflats, Bainsford; borough surveyor. Extension of Gowan Avenue Foundry for Grahamston Iron Co., Ltd.

Finchley.—Extensions to St. Mary's Church, Hendon Lane; churchwardens.

Gateshead-on-Tyne.—Alterations to the Belle Vue Hotel; J. W. Corking, architect, 16, West Street.

Gillingham (KENT).—St. Paul's Union Church (£4,600); Lovell & Sons, builders, Castleford, Yorks.

Glasgow.—Houses (38), Netherton; housing director. School, East Keppoch; education director.

Glossop.—Extensions to Littlemore School, Victoria Street; Independent School Trustees.

Halifax.—Extensions, including paying patients' ward and isolation block, Royal Halifax Infirmary; Walsh & Maddock, architects, 10, Harrison Road.

Hampshire.—Senior boys' school at Fareham, for the E.C. (£12,900).

Hanley.—Estate development, Victoria Road; Watkin and Maddox. Buildings, Sun Street; Northern Greyhound Racers (Hanley), Ltd.

Hawarden (CHESHIRE).—Houses (40), Ewloe; R.D.C. surveyor.

Hertfordshire.—Equipment of Cell Barnes Colony, St. Albans (£15,000); county architect.

Hornchurch (ESSEX).—Cinema, with shops, High Street (£75,000); L. H. Kemp, architect.

Hull.—Coach station, near Ferensway; L.N.E. Railway. Schools, Pickering Road and Hall Road; city architect.

Inverness.—Houses (62); W. Smith, architect, High Street.

Irish Free State.—(ABBEYLEIX).—Conversion of Heywood House into County Home; T. Reilley, Laoighis Board of Health and Public Assistance District Hospital.

Keighley.—Houses (20) and shops (2), West Lane; Waterhouse & Pickles.

Kelso.—Houses (40); R. W. McVey, architect, Town Hall.

Kidderminster.—Works extensions, Beauchamp Avenue; Empire Carpet Co. Alterations and additions, Stourvale Ironworks; Baldwins.

Lanarkshire.—Houses, Shotts (88) and Carmyle (20), with electric lighting work; P. C. Smith, 13, Clydesdale Street, Hamilton.

Lancashire.—Schools, Huyton area, Liverpool, and Fleetwood, for the County E.C.; director of education, Preston.

Liverpool.—Houses, Liverpool Road, Sefton Lane, and Deyes Lane, Maghull; H. Kelly, builders, 27, Willow Hey, Maghull. Extension of the Lourdes Hospital, Paul Street; Sister Superior. Houses, Gerard Street; land steward and surveyor, Municipal Buildings. Extension of chemical works for Brotherton & Co., Ltd., Port Rainbow, Bromborough.

Llanharan (GLAM).—Dairy; Architects' Department, Co-operative Society, Ltd., Balloon Street, Manchester.

Loftus-in-Cleveland.—Primitive Methodist Church; Kitching & Co., architects, Middlesbrough.

London.—(ST. JOHN'S WOOD).—Block of flats, Abbey Road; Gunton & Gunton, architects. (LEYTONSTONE).—Bazaar stores, High Road, for F. W. Woolworth & Co., Ltd., Kingsway, W.C. (CITY OF LONDON).—Extensions to Freeman's Girls' School (£10,000); city engineer. Additions to works, Perivale Lane, for Clements, Newling & Co., Ltd.; H. J. Manchip, architect, 49, Windermere Road, N.10. (BATTERSEA).—Hall, &c., Southlands Library (£2,114); borough engineer.

Macclesfield.—Extensions to the mills of Bollington Printing Co., Ltd.; H. Cumberbirch, builder, High Street, Bollington.

Manchester.—Bank premises, King Street, for the Midland Bank, Ltd.; Sir Edwin Lutyens.

Melbourn (HERTS).—Houses (38); R.D.C. surveyor.

Merton and Morden (SURREY).—Refuse disposal works (£14,500), for U.D.C.; G. Jerram, surveyor.

Newcastle-on-Tyne.—Houses (33), Tiverton Close; F. M. Dryden, architect, 6, Market Street. Public elementary school, Ferguson Lane Estate; Education Department, City Council, Northumberland Road.

Norwich.—Covered poultry market; city surveyor.

Ongar (ESSEX).—Houses (58); R.D.C. surveyor.

Penwortham (LANCS).—R.C. church of the Little Flower; Rev. R. Mayo, 1, Winckley Square, Preston.

Preston.—Houses (26); A. Threlfall, builder, Leyland. School for Girls (£30,000); W. R. Watson, architect, 22, Dowanside Road, Glasgow, W.2.

Ormskirk.—Extensions, Isolation Hospital, Holly House, Aughton, for West Lancashire R.D.C.; Metcalfe & Metcalfe, architects, 3, Stanley Street, Liverpool.

Ramsgate.—Extensions, Christ Church day schools; W. T. Stock, architect, 57, Queen Street.

Rutland.—Schools for the Oakham Parochial Council; H. Francis Traylen, surveyor, 16, Broad Street, Stamford.

Salford.—Police quarters, Regent Street (£5,420); chief constable.

Sandyford (STAFFS).—Houses (52), High Street; S. Hancock.

Sheffield.—Church of St. Polycarp's; H. O. Potter, architect, 8, St. James Street.

Slough.—Covered public market (£15,000); F. Iona-Smith.

Southend-on-Sea.—Sports stadium, with restaurant, ballroom, &c., for Southend Stadium, Ltd.; Gregory & Newitt, engineers, 18, Hyde Street, London, W.C.

Southgate.—Public house, Chase Road; A. W. Blomfield.

Southport.—Junior school, Birkdale; L. Barnish, architect.

South Shields.—Houses (16) and shops (4), Tyne Dock (£5,000); J. P. Watson, surveyor, Town Hall.

Spilsby (LINCS).—Houses (28); R.D.C. surveyor.

Staines.—Houses (226) and shops (6), Kingston Road; F. Taylor, Junr., & Co.

Stirlingshire.—New church of St. Helen's, High Bonnybridge; the minister.

Stockton-on-Tees.—Houses (172), Sunderland Glebe Estate; J. P. Wakeford, borough engineer, Town Hall.

Stoke-on-Trent.—Estate development, Littlefields, Trent Vale; Adams & Edwards, architects.

Surrey.—School, near Tooting Bec Golf Course, for the E.C.

Sutton and Cheam (SURREY).—Houses (140); U.D.C. surveyor.

Swansea.—Reconstruction of the Mumbles Tivoli Cinema; S. R. Crocker, architect, Rochester House, Portland Street.

Thirsk (YORKSHIRE).—Rebuilding the Gaiety Cinema; F. Martin, manager.

Tynemouth.—Rebuilding business premises, Bedford Street; W. Stockdale, architect.

Urmston.—Cinema, Atkinson Road, Gloucester Road, for a local syndicate; W. Thornley, architect, 46a, Wallgate, Wigan.

Wakefield.—Dairy, Dewsbury Road, for Wakefield Borough Industrial Co-operative Society, Ltd.; G. Crook & Son, builders, Alverthorpe, Wakefield.

Wallasey.—Completion of promenade improvement scheme (£440,000); borough engineer. Development of Zig Zag Hall Estate; Wallasey Estates, Ltd.

Warwickshire.—Extensions to Atherstone Grammar School (£4,000); county architect.

Westborough.—School (£11,000); Guildford E.C.

West Cornforth (DURHAM).—Conversion of premises into cinema, for W. W. Turnbull & Co.

West Sussex.—Junior and infants' school, St. James's Road (£12,000), Chichester; county architect, Chichester.

Whitehaven.—R.C. schools, Kells; priest-in-charge.

Wigan.—Additions to premises, Dawber Street, for the Wigan and District Equitable Co-operative Society, Ltd., 98, Standishgate; society's architect.

Wimbledon.—Extensions to fire station (£3,700); borough engineer.

Winchester.—Children's block, Hampshire County Hospital; secretary.

Wood Green.—Factory extension, Nightingale Road; British Couverture Co., Ltd. Seven shops, Roundway; W. H. Heath.